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The Work and Life of Dr. R.H. Richharia

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The Life and Work of Dr. R. H. Richharia

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Social Change Paper 27

Bharat Dogra

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Price Rs 100

1991

Published by Bharat Dogra D-7, Raksha Kunj, Paschim Vihar New Delhi-110063 India .

Composed at Disha Printers, Asthal Bohar Rohtak and printed at J.K. Offset, 315 Matia Mahal, Garhaiyan Wali Gali, Near Jama Masjid,Delhi.

This book is dedicated to my late parents - Sh. Shyam Saran and Smt. Sushila Shyam

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Acknowledgements

My heartfelt thanks to my family and friends for creating conducive conditions in which this book could be written, to all those who helped (or will help) to print and distribute this book and to those from whose work, ideas and suggestions this book has benefited

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Note - One crore = ten million, one million = ten lakhs

INTRODUCTION

Working as a development journalist during the last about 15 years, there are certain debates in food and agriculture related issues to which I find myself returning again and again. I find these issues being discussed at various fora and in different contexts, testifying to the increasing realisation of their importance.

1. The first issue concerns the conservation and control of plant genetic resources. One of our biggest concerns in food and agriculture is to save the tremendous diversity of plant genetic wealth that has existed, specially in tropical countries, but a related crucial question that needs to be asked is - who will control this preserved genetic wealth and use it for what ends? For social welfare or private profit?

2. The second question concerns the comparison of those farming systems which have evolved over hundreds of years (and carry with them the accumulated wisdom of forefathers for that particular agro-climatic location) with the alien systems imposed from above. It has been the increasing practice in many developing countries, generally as a result of the advice and 'aid' from developed ones (or by institutions dominated by these countries) to reject the entire farming system, as it has evolved in various forms in the country from location to location, in favour of a centralised, costly, dependent and ecologically hazardous system whose only likely asset (publicized out of all proportion to the real capacity) is its ability to increase yields (although even this ability has been gravely in doubt as per the actual experience of several regions).

The mass media has been used effectively to ensure that only the real and imagined gains of the above system are heard, so that it becomes embedded in the public mind as an enormously 'improved' system compared to the inherently

'backward' system it replaces. In the scientific establishment a situation is created whereby it is known that those who spread this new gospel will prosper and those who question it will suffer in the existing system.

It is not at all our intention to romanticise or idealise the farming systems which had evolved over a long period. Parts of some of these systems were based on exploitative use of labour. This has to change. Parts of these systems had been ravaged during colonial rule by neglect of irrigation and enforced changes in crop rotations. These distortions in fact were the real cause of the decline of these systems' ability to produce enough food and needed to be remedied. But instead of this remedial action the entire uprooting of the farming system was suggested. A once strong and beautiful house that needed some repairs to recover from the effects of a storm was ordered to be demolished.

3. The third question concerns the overall role of foreign aid and collaboration. Ordinarily developing countries suffering from food shortage would be grateful for any help from institutions/aid agencies of areas which in recent decades have seen more scientific advancement to increase their food production. But what happens when such offers of help are more motivated by considerations other than reducing food shortage in the recipient country? What happens when the main motive of 'aid' is to gain such control over the food and agriculture of the recipient country, and to guide it along such a path, as to ensure more business and economic power to the agribusiness interests in developed countries? Or when this aid is used to create dependency that will serve the wider political goals of the donor countries? Towards this end, attempts are made to control the plant genetic wealth of the recipient and to make the country dependent on those seeds, fertilisers, pesticides and other inputs in which the agribusiness interests of developed countries have a high stake.

4. The fourth question concerns the role of scientists, of all scientists but specially the agricultural scientists. The powerful interests who want to control food and agriculture systems for

profit understand very well that the entry to this field is through the lane of scientific research. Control this lane and the chance is that you can control the entire field to a large extent. Specially in a large country like India this control is sought to be achieved first by increasing the control of a central authority, and then by trying to dominate this central authority. A situation is sought to be created in which the scientists understand that the road to fame and success lies in orienting research to what is required to be heard by these controlling interests. On the other hand, this also starts becoming increasingly clear that defiance of the controlling interests can cause quite severe problems for scientists. So many scientists learn how to live with the existing conditions for survival and prosperity. But a few do not. They see the constraints of the system yet they are not willing to allow their voice to be stifled. What is the system's response to these scientists? How wide is the impact that this courageous stand of these scientists can make? Is it possible for them to find friends who will stand by them and help to make their voice heard? If the scientific establishment neglects him/her, is it still possible for such a scientist to continue scientific work.

I've tried to cope with these questions in villages, libraries, farm research institutes, farm universities, in the studies of several scientists and I've always felt that the life and work of Dr. R.H. Richharia offers the most fascinating and inspiring example of a scientist who never surrendered to the many sided onslaughts of the vested interests. His life and work provide invaluable insights into all the major issues raised above. This is the reason why this book needed to be written and this is the reason why this book needs to be read.

2

This chapter gives a brief description of the life and work of Dr. R.H. Richharia

PROFILE OF A PEOPLE'S SCIENTIST

Prof. P.S. Hudson, the venerable botany scientist at Cambridge, was just settling down to some long painstaking work at his lab when the sudden appearance of an earnest young man startled him.

The Professor scratched his head. Yes, he remembered having seen the youth somewhere, but exactly where he could not recall.

"Sir", the young man sought eagerly to refresh his memory, "I hope you remember that when you came to Nagpur some time back, you had praised my work and invited me to come to Cambridge for my doctorate."

Oh yes, the moment came back to the Professor in a flash. He had been visiting some labs of India when he chanced upon this brilliant student Radhey Lal Her Lal Richharia who was doing his M.Sc. at Nagpur. The student had been singled out to Prof. Hudson as his original scientific work had already won appreciation at prestigious fora of scientists.

Interested, Prof. Hudson had taken a close look at some of this student's work. Then, in a gesture of appreciation of the

work he had said, "You must come to me at Cambridge for your doctorate."

But after this there had been absolutely no correspondence, no follow-up, no indication at all that this student was actually planning to come to him for his doctorate.

"I have come without any papers and without any formalities, with just your words to support me. I did not have any money to come here, nor do I have money to stay here. I could come only because I passed an exam for a scholarship which is meant to send students for ICS (Indian Civil Service) exams", the student explained.

So here was a brilliant student very keen to do scientific work but with a scholarship for an entirely different purpose. The problems in admitting him for doctorate were immense, but Prof. Hudson also hated to lose such talent to the ICS.

So he told the student that he could start working at the lab, pending a final decision on admitting him for doctorate at Cambridge.

This is all the encouragement the youth needed. He said good bye to his colleagues who had come with him to appear in the ICS exam, and settled down to rigorous work at the lab, working all the day into the night hours, just as he had done at Nagpur.

Unfortunately the new cold environs did not suit him. He soon had an attack of pneumonia. But this did not prevent him for coming to the lab and pursuing his work with almost the same rigour as before. His zeal for work, as well as the excellence of work as revealed in the preliminary results, did not escape his teachers.

Despite the absence of many formalities, he got his admission for the doctorate course at Cambridge.

In less than two years he had obtained his doctorate.

Unfortunately, however, he did not have the means to return home. The Indian High Commissioner graciously stepped in to help. And at the age of 25. Radhey Lal Richharia

was back among family and friends in India, with his richly deserved doctorate from Cambridge.

His Professor from Nagpur who had called him mad for venturing to even think of getting his doctorate from Cambridge now had to reconsider his opinion.

Several promising avenues were now open for the young scientist. But he remembered every word of the parting advice he had got from his senior teacher at Cambridge. Before leaving, he had gone to say good bye tc Prof. Engledow who patted him affectionately and said,

"So many scholars who return from Cambridge to India go on to hold many prestigious posts and to publish many learned papers. But I do not know how many of them actually strive to help the farmers of India. The real test is whether your work will be of real help to the poor farmers of your country."

There parting words from the seat of learning which he valued so much made an indelible impression on the young scientist's mind. In the midst of all his future struggles and achievements (both of which he was to experience in plenty) he would never forget these words - your work is valuable only if it really helps the poor farmers.

Radhey Lal was born in 1909 in Nandanvara village of Seoni Malwa tehsil, in Hoshangabad district of (what is now) Madhya Pradesh. His father Her Lal Richharia was the headmaster of a school and also the post master. Always keen to do some new work, he experimented with growing several vegetables in his garden.

But he did not grow vegetables just like that. He had careful and painstaking methods of growing the various vegetables. In some cases, he would not use any direct irrigation at all, preferring instead to use the percolation method, saying that this way the land would make more efficient use of water. Then in the case of some vegetables which grow on creepers, he would insist that the creeper be given the support of a neem tree. The belief probably was that the vegetables would absorb some of the undoubted medicinal properties of the neem plant.

All this while his curious son looked on eagerly at his father's work, fascinated by all the interesting information that was revealed when he asked questions. The child learnt to admire and respect the wealth of wisdom that was available within the villages.

He was equally fascinated by the visitors from forests, or adivasis, with whom his father had great rapport. Specially fascinating was the 'Rani Sahiba', who seemed to have been a tribal head woman of sorts, with whom his father appeared to have an arrangement for care of animals. It appears that villagers then had an arrangement with some forest people to take their domestic animals to forests during the dry season. The tribals also collected chiraunji seeds and not only brought this to his father but also prepared beautiful storage for keeping them unspoilt. What the adivasi visitors spoke revealed their rich wisdom of trees and plants. Radhey Lal learnt of this wisdom at an early age, and also the memory of the friendly relationship of mutual help between his father and the friends form forests lingered on in his memory.

His father watched the growing interests of his son in plants and visitors with interest and encouraged him, allowing him to sit and listen to the conversation with the tribal people, or taking him to the market to meet them. Little did he realise that this little boy will grow up to become one of the biggest defenders of tribal heritage, and that some of his valuable work and publications would be dedicated to the tribal farmers of India.

Before he left his villages for higher education, Radhey Lal had imbibed enough knowledge about the wisdom of farmers in general and tribals in particular, a knowledge that would enable him to retain his humility and attitude of respect for them even when he approached them after earning his doctorate from Cambridge.

Radhey Lal was such a brilliant student that his officially recorded date of birth had to be lowered by two years (from 1911 to 1909) to enable him to sit for school exams for which he was obviously well prepared, but for which he was still well

below the required age. In fact at one exam he had to be helped to climb the seat which had been designed for older students.

Radhey Lal soon left his village to pursue his further education at Balaghat, then college level education at Varanasi and Nagpur. From Nagpur he went straight to Cambridge and it so happened that on returning from Cambridge, the first job that he got was also at Nagpur - as oil seeds specialist for Central Province (1931-42). From here be went to the Agricultural Research Institute and Agriculture College at Sabour (District Bhagalpur, Bihar) where he held various positions and developed his keen interest for rice which was to become a life long passion. He also showed his flair for field level work compared to desk work by motivating students to do the actual work at fields and dairies, thereby earning themselves a rich breakfast of halwa (a sweet dish) and milk.

On a more serious note, he started pioneering work on preparing quality fibre from the waste straw of linseed plant, a work which drew the attention of several eminent persons. He remained in Bihar for 17 long years, from 1942 to 1959.

Then in 1959 he was selected as the Director of the Central Rice Research Institute (CRRI) at Cuttack, Orissa. No sooner had he reached there to assume charge, however, that a rival who wanted the post for himself manipulated a strike by employees so that he would not be able to settle down in the new work. This hurdle could soon be overcome, however, and Dr. Richaria was able to establish the CRRI as one of the foremost centres of rice research in the world, the value of work done where was widely talked about

However, vested interests conspired against him to disrupt him work. He left the CRRI in 1967, unjustly deprived despite his seniority of the opportunity to become the Director General of the Indian Council of Agricultural Research (ICAR).

In 1971 he was recalled from retirement to head the Madhya Pradesh Rice Research Institute at Raipur and also to function as Agriculture Adviser to the Government of Madhya Pradesh. His work here from 1971-1976 was again pioneering

work of great value, with special reference to preserving and protecting the agricultural heritage of tribal farmers. Again, however, vested interests manipulated things to deprive him of opportunities to continue work of great value which had reached a critical stage.

From 1978 to 1991 Dr. Richaria, now deprived of all facilities for scientific work, has continued his work against great odds at his residence and at a farm located a few miles away from his residence in Bhopal. This work continues to this day at the time of writing.

In 1971 Dr. Richaria lost his wife, the late Mrs. Jaiamba Richaria, who had been his greatest source of strength in the middle of several difficult struggles. Around 1982 he lost a son. In 1984 he become one of the victims of the Bhopal gas tragedy, the man who had spoken all his life against the hazards of chemical pesticides and distorted development trends himself became the victim of the same trends. In December 1984 he had a heart attack the after effects of which left him very weak.

But he withstood all there tragedies and shocks to continue his work. His daughter Utpala combined a busy professional life with affectionate care of her ailing father. Other members of his closely knit family also helped to keep up his spirits after all the harm he had suffered from the hands of manipulators. Several of his old students scattered all over the research and teaching establishments also extended moral support from time to time. They kept him in touch with recent development in research and confided how the value of what he had said and done much earlier was being realised now. "Sir. they have only given a new name to some of your old work by calling it biotechnology, but to what purpose they will use it is quite another matter," one of his students said.

Slowly information of his work and realisation of its importance became clear to several members of the press, voluntary agencies and other people's organisations. Reports of his work started appearing in several newspapers, magazines and journals. Voluntary agencies requested him to visit their areas and tell people about his work. He was invited to

important gatherings of pro - people science in Malaysia, Indonesia, Nepal and elsewhere.

Despite numerous adversities, he was able to write and publish a very important book on clonal propagation technology. A new edition of his old book, 'Rices of India', co-authored with S. Govindswamy, has also been published recently.

At present he is working on an encyclopedia of rice germ plasm of Madhya Pradesh in which 20000 cultivars of rice will be listed. This is the result of several years of the collection and identification of rice cultivars, a work which has continued even after his retirement from official work. He is also completing the botanical survey work with special reference to rice and rice research conducted by him during the seventies in MPRRI. He is also continuing his tireless work in preparing a Botanical Dictionary of useful plants of India. This work was started in 1946-47 and over 8000 entries have already been made (with available chromosome family name, botanical name, popular English and Hindi name, uses and other information). In additional be continues to carry out botanical research on his farm and has been working or evolving interesting concepts such as these of rice garden and rural gene banks.

All this work he has been doing with the minimum of help and support from outside. Some help, however, has been extended by the two agricultural universities in Madhya Pradesh and by some voluntary agencies / institutions by agreeing to publish a part of his voluminous work.

In the course of his careful, painstaking and brilliant research work extending over six decades, Dr. Richharia's work has been distinguished by some important features which are:-

1. A respect for the wisdom and knowledge of ordinary farmers, specially tribal farmers.
2. A deep concern for the small and poor farmers, an understanding of their resource countraints and efforts based on this understanding to make available

low-cost, local resource based technology. Thus his technology involves no chemical pesticides, although very low doses of chemical fertilisers are allowed.

3. A respect for the indigenous genetic base of crops, and a great concern to preserve the indigenous germplasm. Efforts to increase rice productivity should be based mainly on indigenous varieties. Towards this end he made a great discovery of the hidden potential of indigenous rice varieties, their high productivity and superb food qualities. In Madhya Pradesh he collected (or guided the collection) of over 17000 cultivars of rice.

3

In this chapter it is argued that it is not enough for scientists to try to solve the problems in bits and parts, they should seek to understand the traditional farming system in its entirety - its strengths and weaknesses before they give solutions that will be truly helpful to farmers.

HOW SCIENTISTS CAN BETTER SERVE FARMERS

A decade and a half back, in a frank assessment of one of the most important shortcomings of our farm research effort, the National Commission on Agriculture had clearly admitted. "The contacts of the research scientists with the end-users of the results have been loose. This leads to delays and often confusion and what is more harmful, a complacent attitude on the part of research scientists. Again since extension has been thought to be less important a vocation, it has been relegated to the less enterprising scientists. The results are disastrous."

Regarding the selection of problems for carrying out research, this report notes that most often the researcher gets at this problem by reading scientific literature in his own discipline, either Indian or foreign, and somehow tries to fit in with local or Indian conditions. Rarely does he go out in the field and pick up his problems from his own direct observations or those of his colleagues engaged in field work.

Unfortunately the recognition of this serious problem by the National Commission of Agriculture has not been followed by the necessary steps which could have made these observations irrelevant. It should be added that the blame does not rest entirely on them, there are several other aspects of this problem which dampen the initiative of scientists in this direction.

But at least there is a growing recognition of this shortcoming and it is widely believed that scientists should study more closely the field-level problems of ordinary farmers instead of working in isolation.

However there is another missing aspect of the inter-action of farmers and scientists the importance of which is not even being recognised. While it is time and again stressed that scientists should inter-act closely with the farmers to understand their problems, the need for scientists to learn about the strength of the time-honoured methods and practices used by the farmers which have evolved over a long process of trial and error, helped by the experience and wisdom of several generations, is seldom pointed out. Without understanding the special need of the crop-rotations grown by farmers and the utility of the crop-varieties popular among them, new rotations and varieties are recommended.

The danger in this is that in the effort to solve the problems of farmers, the scientists may end up making recommendations which also do away with some important assets of the farming system that is sought to be replaced or changed. Without understanding how important some hardy local varieties are, or without having a grasp of the non-chemical methods used by the farmers to keep away pests and maintain soil fertility, the scientist will not even be aware of the harm that may be caused by the introduction of a new system which does not have room for the continuation of such practices and varieties.

There is a growing tendency to measure agricultural performance narrowly, in terms of the crop yield per ha it gives. However, from the point of view of the farmer obtaining the

subsistence food to which he is used (in terms of nutrition, taste and other qualities valued by him), obtaining fodder for domestic animals, maintaining the fertility of land, ensuring survival of at least a part of the crop under adverse weather conditions, obtaining protection from pests and disease without having to incur cash expenditure-all these may be equally important. Thus over a long period of time farmer may have evolved methods of farming which though relatively low in per ha. yield are nevertheless very useful for him from these other points of view.

Now a scientist who looks only at the problem of low yields without understanding the various assets of the farming methods being practised by farmers for a long time, may end up recommending methods of obtaining high yield which, however, are less useful when looked at from these points of view. The scientist is happy that he has found a way out of the low yields of farmers but he is disappointed when the farmers refuse to adopt the new farming methods on a large scale or give it up after trying it for some time, or when discontent begins to simmer among farmers some time after adopting the new methods.

The scientist and his colleagues, unfamiliar with the several plus points of the old system which they do not want to miss out, may conclude that the farmers are so conservative as to resist change which benefits them so clearly - in their perception. Unfortunately such an attitude is often seen among scientists and they complain that despite the availability of very good technology thanks to their efforts, farmers are not adopting it. Such an attitude will not help them or take the agricultural development effort very far. Reasons of this reluctance to adopt their recommendations have to be sought out, and corrective action taken. And in this process it is important that the scientists became closely familiar with the assets and plus points of the old methods practised by farmers.

Farm scientists have to play a very important role in India. There is no doubt that several of them today feel an intense desire to play a more relevant role in the service of farmers.

The number of students in agricultural universities and other institutes having such noble ideals is no doubt even larger. For such a desire to become a reality, however, a certain change in the pattern of thinking and working of scientists is necessary. They should go to farmers not only to inform and teach, but also with a spirit of learning from them. Knowledge from books and labs should be combined with the earthy experience of several centuries to take the country forward on the path of agricultural development.

4

This chapter explains how the germ-plasm exchange network has been heavily biased in favour of rich countries and the business interests there.

NORTH-SOUTH CONFLICTS OVER GENETIC RESOURCES

Due to various climatic, topographical and other reasons many of the present day developed countries are poor from the point of view of genetic diversity of their plant wealth, while many of the developing countries are extremely rich from this point of view. Under these circumstances it is perhaps only to be expected that several developed countries have been anxious to get the genetic wealth from developing countries to help them in increasing their crop yields, obtain resistance from diseases and meet other objectives. At the same time a large number of plant varieties are being lost in their natural environs due to deforestation, HYV agriculture and other wrong policies. With the recent advances in genetic engineering and the great business opportunities opened up by the control over seeds, a new urgency and a big thrust has been imparted to these efforts as big companies in agri chemicals and other lines have become anxious to gain control, even exclusive control over seeds to reap commercial profits. Suddenly seeds have become a big business. A further dimension has been

added by the political significance of control over seeds - how this can be used to pressurize a dependent government into submission of various kinds.

Under the circumstances it is not surprising that this has been the subject of heated political debate at various inter-national fora. As Edward C Wolf reported in 'Environmental Awareness' (Vol.8, No.3, 1985), on the 22nd biennial conference of the F.A.O. where a proposal for a coordinated network of national, regional and international centers for base collection of plant germplasm was being debated.

"Controversy erupted around the proposals' endorsement of the principle of 'free exchange of germplasm'. At issue was whether elite breeders' stocks, the product of long and costly commercial breeding efforts, should be exchanged among countries on the same basis as wild species and traditional cultivated varieties that had never undergone deliberate scientific selection for their traits (this itself is questionable). This United States, Japan and countries of Western Europe felt the FAO proposal undermined economic interests and contravened laws that made some breeders' stocks proprietary material in other countries. Its advocates, including Colombia, Cuba, Libya and Mexico, countered that the breeders in industrial countries currently had free access to the genetic resources of developing countries that they then developed into commercial varieties to be sold back to the Third World at considerable profit."

Reporting on the same event in Ecoforum. (Volume 9, No. 5, November 1984) Ronald A Kingham wrote,

"The international political fight over the control of genetic resources at the conference was fierce, and is likely to continue to be. The North and South were sharply divided over three main issues.

(1) the question of a legal convention versus a voluntary undertaking (2) the question of what kinds of genetic resources would be included and (3) the question of who should control the new system."

Further, "Third world delegates were arguing that genetic material from their countries which is stored in the North is not always freely available to them and that sometimes access can be denied for political reasons. Control over plant genetic collection, conservation, and exchange is largely vested in the hands of the International Board for Plant Genetic Resources ((IBPGR). According to an ICDA (International Coalition for Development Action) study, over 90% of the collected plant material is now held in Northern gene banks and is often inaccessible to the south where 75% of the material came from originally.... Another independent study says that one third of the material in gene banks may be diseased. Third World governments are also concerned that in its collection and grant funding policies, the IBPGR has facilitated a 'gene drain' from South to North".

Such concerns are widely shared by the well-wishers of the Third World. One of the most prominent such researchers Pat Roy Mooney wrote in his pioneering work "Seeds of the Earth", "Important as gene banks may be, it would seen unwise for the world to put all its eggs in one basket. The Third World, on the other hand, is being invited to put all its eggs in some one else's basket".

In India the most controversial case has been that relating to the foreign interference in the rice germplasm collection at Madhya Pradesh Rice Research Institute (MPRRI) in Raipur. Recently at a conference on 'Crises in modern science' in Malayaia (November 1986) the former Director of MPRRI and Central Rice Research Institute (CRRI) Dr. R.H. Richharia summed up his experience of dealing with the International Rice Research Institute (IRRI) in the course of heading two important India institutes in these words.

"As a result of my knowledge of the working of the three research institutes referred to above, my great discovery of life is that the control of the rice culture which yields the World's most important cereal food is gradually passing on in the hands of a few individuals working at IRRI, supported by unlimited wealth..."

Further he warned "In more recent years there has been a phenomenal progress made by IRRI in collecting the indigenous rice varieties from different countries including those of Oryza glaberrima from African countries and simultaneously replacing them by susceptible HYVs, with dwarfing genes (also known as elite modern rice varieties). Slightly more than half of the world's rice cultivars have now already been assembled at their gene banks and huge areas have been covered by their HYV and elite derivatives. The methods adopted to achieve those objectives are numerous. A stage will soon reach when the indigenous rice cultivars of respective rice growing centers will be only available at that one center and in the circumstance when the so-called elite rices fail to produce enough rice food to feed to local rice eating population, if attacked by such a dreadful virus as grassy stunt virus (against which the resistance gene is available only at IRRI as reported isolated from a wild species, O.Nivera collected from India), the condition can be better imagined than narrated. Further, it is reported that the exiting rice cultivars of the world are all susceptible to this grassy stunt virus. Complete dependence for resistance gene on that center would be inevitable. Resistance to this virus may have been introduced into some IR-bred varieties which would alone be an answer but the resistance may break and at the same time their suitability under different environments could not be ensured. Why create such man-made problems?"

Note- The ' Conference on Modern Science' was organised by the Consumers' Association of Penang and the Third World Network.

5

Rice is by far the most important crop of India, grown on 41 million hectares of land. Government policy on rice emphasises the spread of exotic dwarf fertilizer responsive varieties called HYVs. This chapter on the failure of these varieties gives statistical evidence and opinion of experts.

RICE CULTIVATION - BEFORE AND AFTER THE GREEN REVOLUTION

Rice is by far the most important crop of India. It is grown on nearly 41 million hectares of land.

In the mid-sixties it was decided by the Indian government, goaded and guided by foreign aid organizations and international research centers, to go in for exotic dwarf fertilizer responsive varieties. Several farmers call it 'Sarkari dhan' (government paddy), some researchers call these varieties elite varieties. To follow the official terminology and yet recognize the existence of indigenous high yielding varieties, we refer to these varieties as the exotic HYVs or the green revolution varieties.

According to official data for 1985-86, 24 million hectares of paddy land has been brought under the HYVs (by which the government always means the exotic HYVs). 24 million ha. out

of the total paddy area of 41 million ha. or nearly 59 per cent. The accuracy of the government's data can be debated - as indeed its very definition of HYVs - but for the time being their statements and definitions are being accepted here.

Wherever these exotic HYVs have gone, these have involved a much higher use of agri-chemicals (fertilizers and pesticides) and irrigation. As a result of the overall spread of various green revolution varieties of crops, for instance, the use of chemical fertilizers (NPK) has gone up by nearly 27 times during the period 1960-61 to 1984-85 from 292 thousand tonnes of nutrients to 8211 thousand tonnes of nutrients, and according to the hand book of agriculture 1980-81 published by the Indian Council of Agricultural Research, about a third of the total fertilizer is used for the rice crop alone. Similarly, the use of chemical pesticides during green revolution years has gone up, from negligible amounts to over 60000 tones, and here again because of the large acerage of rice HYVs and their high susceptibility to pests (much more compared to wheat) a significant chunk of pesticide use in agriculture goes to protecting or trying to protect rice HYVs. In addition, the spread of exotic rice HYVs has involved a very heavy expenditure on research/extension.

Now let's see, despite the massive increase on the expenditure on exotic rice HYVs in the form of irrigation, chemicals and research, has, the performance in terms of the rate at which the yield of rice been increasing been significantly better in the post-green revolution phase compared to the pre-green revolution phase (based on indigenous varieties with very limited increase of fertilizer and pesticide use, much lesser increase of irrigation, much lesser expenditure on research)? This is shown in Table 1. The dividing line is drawn around 1965-66 or so.

Table 1.

Period	Actual Yield Kg/Ha	Index with 1950-51 as base
1950-51	668	100
Average for Ist plan (1951-56)	817	122
Average for 2nd plan (1956-61)	915	137
Average for IIIrd plan (1961-66)	986	148
Average annual plans (1966-69)	992	149
Average for 4th Plan (1969-74)	1112	166
Average for 5th Plan (1974-79)	1203	180
Average for (1979-84)	1281	191

Source - derived from Seventh Plan Document Annexure I.

It is apparent from Table 1 that despite the big support for exotic HYVs with chemicals, water and research, their performance has not been significantly better, in fact it has become somewhat worse, compared to growth based on indigenous varieties in the years before the green revolution - in terms of the rate of increase of yield. Even if some other statistical methods are adopted the basic result will remain unaltered that there has been no significant improvement justifying the massive expenditure incurred in growing and supporting the exotic rice HYVs.

What are the causes of the failure of exotic HYVs ? A task-force on rice breeding consisting of eminent experts which met at the Central Rice Research Institute (CRRI) in Cuttak on February 19-20, 1979 and whose report is contained in a

CRRI publication tried to identify some of the causes - mainly the narrow genetic base of the exotic rice HYVs, their unsuitability for much of the rice growing region of India and their alarming susceptibility to pests and diseases. Some remarks of the task force are worth quoting, (in these quotes HYVs should be taken to mean exotic HYVs):

In the words of the task force, " Most of the HYVs are derivatives of T(N)1 or I.R.8 and, therefore, have the dwarfing gene of dee - geo - woo - gen. This narrow genetic base has created alarming uniformity, causing vulnerability to diseases and pests. Most of the released varieties are not suitable for typical uplands and low lands which together constitute about 75 per cent of the total rice area of the country. To meet these situations, we need to reorient our research programmes and strategies. "Referring to this problem of narrow genetic base at another place again the task force says, " A cursory look at the pedigree of the different rice varieties released in India reveals that a very narrow germplasm base is involved. It is also noticed that many times the same female parent is involved in the cross combination."

In a reference to the increased pest susceptibility of the now crops, the task force says, "The introduction of high yielding varieties has brought about a marked change in the status of insect pests like gall midge, brown planthopper, leaf folder, whorl moggot etc. Since most of the high yielding varieties, released so far, are susceptible to major pests with a crop loss of 30 to 100 per cent, development of high yielding varieties with built-in-resistance has become highly essential to stabilize the yields."

Development of pest-resistant varieties is no doubt very important, but when it comes to examining the past record in this field, again the task force has sad things to tell.

"The results of the insect resistance breeding programme so far are not very encouraging. Even though a few varieties have been released as resistant to pests, except Ratna, no other variety is having a good spread in the country. A good stem

borer resistant variety is yet to be developed for which a good donor is to be first identified.

"For gall midge, even though the donors are highly resistant, unfortunately most of the resistant varieties, released so far in the country, are either poor yielders or do not show consistency in resistance when grown in different locations. Here also high yield and stable and high degree of resistance are yet to be combined. " Referring to some specific efforts, the task force reported, " During 1977 Kharif, when the gall midge resistant cultures were grown in new endemic areas - viz Singeda, Kune and Bandu in Bihar, most of the promising resistant cultures recorded susceptible reaction suggesting possible presence of a new virulent biotype of rice gall midge in these areas."

While disease-related problems were getting worse in some respects solutions were not in sight. Specifically regarding the problem of sheath blight, the task force reported.

"The disease is now becoming more serious due to the increased plant population density, high tillering and higher nitrogen dose ..... so far varieties with a high degree of resistance have not yet been identified."

To the findings of the task force given above (made in 1979), we may only add that most of these problems of exotic HYVs still persist - in fact these are inherent in the exotic varieties not at all well adapted to the environmental conditions in which these are grown in India. This is evident also from the continuing poor performance of HYVs, as seen in Table 1. In fact this table shows that the performance after 1979 (when the report of the task force was written) has been even worse than in the earlier green revolution years.

In addition the exotic HYV technology is also not compatible with the low resource base of the Indian farmer who is basically a small farmer with lower capacity to take risk and invest in expensive inputs.

So far we've talked only of the failure of exotic HYVs in terms of productivity but in addition if egalitarian factors are taken into consideration, it can be shown that the exotic HYVs

have worsened the inter-personal as well inter-regional inequalities, with a greater share of the rice production being produced on the fields of bigger well-to-do farmers and in the fields of the well-endowed, better-off regions than before. In fact if we exclude the high productivity of new rice growing areas such as Punjab, then the performance of the green revolution phase of rice production in India would appear to be even more dismal than what has been shown above. To complete the sad story we must add that even the success-story of the high-productivity, new rice growing areas such as Punjab has been only at the expense of heavy ecological costs, specially long-term land degradation.

6

In the previous chapter on the failure of exotic rice HYVs this failure and its causes were established. But there were scientists who had foreseen these factors and so resisted these rice HYVs. They suggested exciting alternatives of great potential. But foreign vested interests exerted pressure at crucial moments to silence them and go ahead with the spread of exotic rice HYVs. One such crucial episode from Cuttack is told here.

CUTTACK - BREACH OF FAITH

By the mid-sixties the Central Rice Research Institute (CRRI) had emerged as clearly the most important centers of rice research in India, and one of the most important such centers in the world. A proposal for turning CRRI into an international center using foreign aid was made but turned down by the Indian government with the consent of CRRI director. It was around this period that research relating to a very important technology-clonal propagation of rice-was reaching a very important stage under the able guidance of the CRRI director Dr.R.H. Richharia. The technology being tried held the exciting potential of significantly increasing rice yield based on indigenous rice varieties exploiting their hybrid vigor and rapidly spreading the improved varieties over a very wide area.

At the same time scientists from abroad specially from the International Rice Research Institute (IRRI) in Philippines were also bringing foreign rice material to CRRI and other places in India.

Despite his firm belief in relying mainly on indigenous rice varieties for rice development in India, the director of CRRI in true scientific spirit kept his mind open to all possibilities and also sought to develop improved, disease free selection of some of these varieties, while keeping a close watch on their behavior and growth.

Around this time some CRRI scientists noticed with alarm that some foreign scientists were bringing disease and pest infested varieties to CRRI (and also taking it to other rice research centers such as the one at Hyderabad) without quarantine certificate and with scant regard for the existing procedures on such matters. These foreign visitors were also unduly influencing some employees of CRRI to carry out activities harmful to national interests in rice production and food stability.

Nearly two decades later the CRRI director Dr. Richharia recollected the goings on around him at a seminar on the 'crisis of modern science' held in Malaysia in November 1986 in the following words,.

"At the later part (of my stay, in CRRI) I passed my time in great distress, because I opposed the interference imposed by IRRI authorities who received at the initial stage all technical help from me and my staff, including the Rice germplasm and even building plans to build up that Institute at Las Banos in Philippines. IRRI were to impose on CRRI their programme and take away its initiative and supremacy which I resisted to protect our interest. The IRRI programme dealt exclusively with the rice culture with dwarfing genes and replace the indigenous rice varieties by IRRI bred IR HYV series and under the pretext of exchange programme to collect the entire rice germ plasm directly and indirectly, through trainees, visitors, some with our knowledge and some without our knowledge, sometimes even bringing their rice cultures

personally to India without quarantine certificates. My devoted band of young scientists soon alerted me and I realized that our programme and findings on rice production technology which had reached a stage to introduce revolution in upgrading India's rice productivity were being suppressed, useful projects being withdrawn and being superseded in preference to IRRI's programme. I, as head of CRRI had no other option but to oppose this interference openly in the interest of my country on the food front."

On March 15, 1966 the then director of CRRI wrote a confidential and extremely important letter to the Director General, Indian Council of Agricultural Research, Delhi.

"The International Rice Research Institute (IRRI) Manila, has been sending a lot of rice experimental material from time to time into this country," this letter said, "and these are grown in several states. It has come to my notice that most of this material are susceptible to a very peculiar disease, not known to this country so far; it is suspected to be virus".

Having sounded this warning the author of this letter went on to state," I may point out that in the last Rice Research Workers' Conference during November 1965, I.R. 9-60 has been recommended as one of the donor parents for hybridization programme in the various rice-growing states. But this material, as has already been reported earlier, has been observed by me at CRRI and two other centers to be infected with the yellowing disease at an early vegetative phase. I may also inform that from some source of information I have learnt that I.R. 9-60 is not only susceptible to Tungru virus, but, also to bacterial blight. As such it is not a desirable material for being used as a donor parent, if used, it may spread diseases wherever the material is grown. Under these circumstances it would soon be beyond our control.

"That some sort of inoculum of this dreadful disease is getting built up in the country is evident from the fact that Taichung Native I which was not showing the yellowing of leaves in the early vegetative phased of the summer crop of last year, has now exhibited it. Since the Ministry of Food and

Agriculture has a huge programme of speedily spreading this variety in the near future, timely action has to be taken against any future, catastrophe of the kind being observed now."

Having sounded these warnings the then Director of CRRI, who is one of the most famous rice-experts in the World, made the following recommendation.

a) Wherever rice cultures from IRRI are being grown they should be carefully watched for which instructions have to be issued.
b) Action will have to be taken to withdraw the hybridization programme recommended under item A(2) of the Rice Research Workers Conference involving I.R. 9-60 as the donor parent.
c) Restrictions will have to be imposed against the free import of IRRI rice material by any source other than CRRI.

Unfortunately, however, these warnings and recommendations were ignored by the top authorities, and instead the writer of this letter was pre-maturely retired from his senior post. The pest and disease susceptible varieties were allowed to be spread.

Simultaneously the efforts to increase rice yield on the basis of clonal propagation technology utilizing indigenous germ-plasm were also quashed. In the words the than CRRI director (again quoting from his paper at the conference referred to above).

"The possibility of exploitation of hybrid vigor by the application of clonal propagation in rice in later generations was demonstrated at CRRI and the results were published in a British Journal 'Nature' in 1962 entitled "Clonal propagation as a practical means of exploiting hybrid vigor in rice" The technique was also explained by me at a seminar held at IRRI in 1963. We were systematically proceeding with the work at eleven different centers in India with success. We had just reached the stage to revolutionise rice production, but all the centers were closed down and instead HYV programme of

IRRI with dwarfing genes was launched suppressing the CRRI work."

7

In this chapter we describe in detail how a brilliant alternative rice development programme was worked out at Madhya Pradesh Rice Research Institute in Raipur in the mid-seventies under the guidance of Dr. Richharia but vested interests sabotaged it so that the exotic rice HYVs remain the only line of development.

RAIPUR-REASON WOUNDED

Some of the most exciting rice research work in India was done under the guidance of Dr. R.H. Richharia in the Chattisgarh region of Madhya Pradesh (M.P.). The institute where most of this work was based was the Madhya Pradesh Rice Research Institute (MPRRI) and Dr.Richharia was its director. Over 17000 cultivars of rice were collected from the Chattisgarh region, several improved selections were made, several indigenous high yielding varieties - tall as well as dwarfs - were discovered and an exciting programme for increasing rice production based on this indigenous germ plasm was evolved.

This work is best described by quoting the various publications of MPRRI brought out at that time in which the details of this work are given. An important publication, written by Dr. R.H. Richharia in 1977 from which we will quote extensively was titled "A strategy for rice production to ensure sustained growth in Madhya Pradesh."

The first and foremost fact which this publication emphasizes is the ready availability of several indigenous high yielding varieties with yields (obtained at much less expense) comparable to or greater than the exotic high yielding varieties. In view of the great significance of this finding, which is still not widely known and recognized, we quote from this document in detail.

"During 1975, nucleus seeds of 967 improved cultures under Bd. (Baronda) series were sent out to different locations (Govt. seed multiplication farms and farmers' holdings) in 17 different districts, mostly tested under normal fertility with no plant protection measures applied. The result, obtained from eleven districts only are presented in Appendices 1 to 5 of A.R.R.C Note No. 9. The average of 121 entries works out to be 3984 kg/Ha of paddy grain or 2669 kg/ha. of rice. In terms of the definition of a high yielding variety in respect of yield 3705 kg/Ha, as accepted by the M.P. Agriculture Deptt. the improved material recommended here can be accepted as high yielding. Comparative high yields observed in some trials are quoted below:-

"Gadur Sela (Bd: 810) from Baster yielded 9746 kg/ha at Badi bag. Balkoni (Bd: 504) yielded 5000 kg/ha in Durg, J.S.5 (Bd: 49) yielded 4820 kg/Ha at Lakhanadown (Seoni), C.R. 1014 (Mrignain) yielded 4800 kg/ha at Chhuriya (Rajnandgaon) T.D. 2 (Bd: 45) yielded 6125 at Bartunga (Raipur) X 10 (Pallavi) (Bd: 193) yielded 4165 at Marod (Raipur).

"On maturity group basis the rice yields observed are indicated below:-

Table

Yield Potential in Kg/Ha

Flowering duration	Paddy grain	Rice
upto 85 days	2500 and above	1675 and above
upto 100 days	3500 and above	2345 and above
upto 120 days	3750 and above	2479 and above

"In the verification trials, carried out by the I.A.D.P., Raipur during 1976 (Appendix 1-A) the average works out to be 3255 kg/ha Bd: 1295 (Chinnor) and Bd: 153 (Dubraj) have been recommended for minikit trials during the next Kharif (1977) and a set of them for local verification trials (appendix I (B). It is of interest to record that a rice variety with restricted adaptability such as Gadur sela (Bd: 810) of Bastar, also referred to above, yielded 9746 kg/ha in anther locality far away from its home at Nabibag (Bhopal district). Similarly an eco-type of Baikons (Bd:10) of Raipur fitted in very well in double cropping pattern in wheat tract of Hoshangabad (Babai). There are many good cultures tested at Seoni Malwa during 1978 which can be quoted to establish that very productive germ-plasm exists in different parts of Madhya Pradesh which can be utilized in increasing rice yields."

This document offers "direct proof to establish that the selected material in the form of Bd: series possesses superior yield potential which can from the basis to increase rice production in immediate future with added advantage that they are palatable and they show resistance to pests and to periodical drought to some extent.

"They have been bred under no plant protection umbrella. This production potential must be tapped and antagonism against indigenous types has to disappear."

Then this document goes on to separately describe the already identified indigenous high yielding varieties, early-maturing varieties, drought - resistant varieties, scented varieties, special flavor varieties etc.

The high yielding indigenous rice varieties already existing

A rice variety yielding 3705 Kg. and above of paddy grain per ha is to be accepted as a high yielding variety the standard accepted by the State Agriculture Dept. "A survey has indicated the about 9 per cent of the indigenous varieties including some clustered types in the state fall under his category under the soil fertility, as maintained by the growers. Such varieties remain confined in sole isolated localities in some blocks or even with

some individual growers. Some of them have been recorded in A.R.R.C. Note No. 5 (1974). Improved selections of most of them are now available, nucleus seeds of which can be had from the Institute. They are known to exhibit field resistance to various diseases and pests in their environments.

Dwarf varieties

The following dwarf types are found to suit many environments in M.P.

1. Bd: 21 (Badal Phool)
2. Bd: 23 (Dhour)
3. Bd: 49
4. Bd: 1353 (Ram Karouni)

Early maturing rice varieties

About 8 per cent of the varieties fall under the early maturity groups. Details have been presented in A.R.R.C. Note No. 5 and 7 of them the Lallu type shows wider adaptability spread very 17 districts. The variety exhibits physiological variations and quality variations (scented and non-scented) which have been utilized in making selection(Bd: 2, a scented type in one of them.)

Drought - resistant varieties

These types show resistance to periodical drought conditions and are suited to up-land conditions (Tikra Bhata lands). Their improved strains are now available which also escape pest attacks. Some of them are very early types, and their fertilizer requirements are also low.

Drought resistance varieties

1.	Chilkat	Bd: 103
2.	Kanakchudi	Bd: 104
3.	Bansgati	Bd: 101
4.	T.D. 2	Bd: 45
5.	T.D. 40	Bd: 46
6.	T.D. 100	Bd: 47
7	T.D.169	Bd: 48

The surveys carried out so far have disclosed the existence of over 237 scented varieties, maintained by the growers in the state. Such scented varieties are Chinnor of Balaghat (village Kaidi), Dubraj of Sehawa Nagri and Kali Muchh of Dabra (Gwalior) are well known.

The least known but much superior rices which can fetch much higher prices for growers are Ti1 Kasturi, Sanudra Chini, Motichur, Katki Kameli etc. New versions giving high yields of most of them are now available.

Non scented quality rices such as Sonakathi, Son Baniko, Hansraj, Katiapati etc. were also discovered.

Very long grain varieties such as Dokra Dekri,Raja Bangla etc. were found specially useful for preparing murra. Dokra Dekri is the world's longest recorded rice.

Chilko variety of rice was found to be used by advasis (tribals) for making good chapatis.

Khowa variety of rice had the taste of dried milk.

Regarding the application of fertilizer, noting that the majority of whatever area exists has only protective irrigation, this document recommends.

"In a situation like this, uniform application of fertilizers, say 15 kg N/ha may be accepted intensively all over the state, where rice grows and this can be our programme for the next Kharif season. There may be a definite recommendation that every rice field should receive a minimum of 15 kg N/ha. In no case the application may exceed 40 kg. N/ha for the indigenous varieties and their new versions. Application of fertilizers in split doses is to be recommended."

Regarding protection from pests the document says, "Emphasis on pest resistant types has to be laid, as such types are being developed rapidly. What we aim at here is field resistance. Methods such as burning the stubbles in rice fields, burning the grasses and weeds on the bunds during the summer months, early sowing and planting of paddy in the same season can also minimise the disease and pest attacks on the rice crop."

Now we quote from another document, prepared by Dr. R.H.Richharia and his staff at the Adaptive Rice Research Center, which was set up near Baronda, in Raipur. This document, dated 1974 and titled "Adaptive Rice Research Note No. 5 - our strategy on the rice production front' makes several important observations, One of these relates to experiments which show indigenous varieties can perform better then exotic HYVs such as Ratna and Sona.

In an experiment carried out at the center (Baronda) evidence was available to conclude that under identical conditions, the two indigenous varieties. Surmatia and Baikoni at 40 kg. N/Ha with cultural manipulations (Phaltai system) out performed or remained at par with HYVs. Ratna and Sona (fertilized at 100 kg/ N/Ha) under Biyasi system with no plant protection adopted. This indicates a value of far reaching significance and has a relevance to the existing situation when Biyasi is practised in 92 per cent of the area in Chattisgarh, and fertilizers and plant protection chemicals are in short supply. This indicates that (1) the dwarfs are not suited to the Biyasi system and that (2) they stand to lose considerably in the absence of plant protection measures (3) With lower doses of fertilizers and without plant protection measures the adapted indigenous varieties yield better or remain at par with the dwarfs, grown with high doses of fertilizers and without plant protection measures. (4) For the dwarfs the two inputs are most essential viz the fertilizers and the plant protection chemicals. In the absence of any one, they suffer heavily and therefore the selected tall varieties are to be preferred.

Further, this document says "In brief for the available dwarf varieties, the extension services have to fight against three essential fronts viz, (i) the environments (ii) the adequate supply of fertilizers and (iii) perfect plant protection measures."

With special reference to the Gurmatia varieties this document says "The famous Gurmatia group of paddy which exists under 52 different Gurmatia types and which are most adapted to local environments with wider adaptability within

the State which are most favoured by the common man and working class cannot possibly be replaced easily for many decades, unless super - types are developed with a similar taste."

It is apparent from these extracts quoted above that invaluable and extensive work had been done at the Madhya Pradesh Rice Research Center in the mid-seventies to pave the way for a significant break through in rice cultivation, to the extent that this could be done within the institutional constraints of land inequalities which are beyond the capacity of scientists. Had this technology, based on indigenous germplasm and the use of clonal propagation technique to exploit the hybrid vigor and rapidly spread the improved varieties, got a fair chance to establish firm roots in Madhya Pradesh as per the plans of Dr.R.H. Richharia and his co-workers at MPRRI, then the rice farmers and food system of Madhya Pradesh (and in following years of almost the entire country) would have benefited greatly but it would have also upset the calculations of those foreign vested interests, or their Indian contacts, who did not want that India's food production should increase significantly and that too in self-reliant ways. In addition their greedy eyes had also fallen on the accumulated genetic wealth of over 17000 cultivars painstakingly collected at MPRRI. So at this crucial juncture the foreign vested interests or their Indian contacts moved in to ruin this exciting programme of increasing rice-yield in a self-reliant way which had been built up with such hard work and brilliant intellect and which had held out such a great potential.

It was a collaborative effort of the leading international rice research center and the leading multilateral aid agency and their Indian henchmen. The scheme worked something like this-offer a big amount (about Rs. 40 million) to Madhya Pradesh for rice research, then lay down conditions saying that duplication of work should be avoided - that MPRRI should be merged with Jawahar Lal Nehru Krishi Vishwa Vidyalaya where simultaneously conducive conditions were created to

gain control of the genetic wealth collected at MPRRI. The scheme worked. It had to. It had such powerful supporters.

Nearly a decade later at a conference on 'crises in modern science in Malaysia, Dr. Richharia recalled the bitter experience of his last days at MPRRI in these words, "I had refused to pass on the entire rice germplasm to the IRRI without studying it, although I had agreed to give some material which we had studied, under their exchange /sharing of genetic resource programme on which I have my reservations. It is obvious that IRRI moved through the World Bank (which is connected with IRRI though the Consultative Group on International Agriculture Research - CGIAR - of which India is a member). It is indeed, amusing, how a private organization like the IRRI originally established by the Rockfeller and Ford Foundations, which are again non-governmental, can enter as deep as even to reverse firm Government decisions of a State Government to achieve their objectives (This case can serve as an eye-opener). The objective behind this move was to get possession of the most valuable and rare genes from this region the knowledge of which was made available there (IRRI) through various sources, including the visits of the staff of that institute. This was possible only when my control on my own material was removed and passed on to the local farm university, established on the pattern of Land Grant colleges of America of which the Vice-Chancellor was one whose name appears on a list of the Board of Trustees of IRRI (as now I see it) who had once advocated the cause of complete transfer of my rice germplasm to IRRI who would maintain it for us (instead of favouring the creation of facilities for its maintenance under his own control as Vice-Chancellor). This was totally achieved and free play and control on my germplasm introduced."

8

In 1983 Dr. Richharia received a letter from the office of the Prime Minister of India, Mrs. Indira Gandhi, requesting him to prepare an action plan for increasing production of rice. This chapter gives same important aspects of this plan.

A PLAN TO INCREASE RICE PRODUCTIVITY AND HELP RICE FARMERS

For about 15 to 20 years after independence, taking an overall view, rice productivity increased but at a slow rate. During the mid-sixties exotic dwarf fertiliser responsive rice HYVs (high yielding varieties) were introduced with the stated objective of stepping up the rate of increase of rice yield. But in reality the performance of the next 15 to 20 years (the green-revolution phase) has been below what was already being achieved in the pre-green revolution years at much lower costs, or at any rate it is not better.

In this situation, 'a silent rice revolution - a specific plan of action for increase in productivity of rice' formulated by Dr. R.H. Richaria, one of the most eminent rice scientists, appears as a ray of hope. This specific plan of action was formulated by Dr. Richaria at the request of the Prime Minister's office in 1983 and regardless of what the P.M's office does with it (it does

not appear to have done anything so far) it will remain an invaluable document for all concerned sincerely with the task.

But first a few words about Dr. R.H. Richaria. After doing his M.Sc. (Botany) at Nagpur, first class, he obtained his Ph.D. at Cambridge University. He started his scientific career as oilseeds specialist to Madhya Pradesh (M.P.) Government at Nagpur. He then went to Bihar where he held various posts in course of his stay here - economic botanist, rice specialist, Prof. of Botany, Principal of Bihar Agriculture College and regional director. He is credited for initiating and organising the post-graduate courses in the faculty of Agriculture at Bhubaneshwar under Utkal University. At Sabour he reorganised and expanded the rice and botanical section with 8 research sub-stations in different parts of Bihar.

He was for several years the Director of Central Rice Research Institute (CRRI - Indian's more important centre of rice research) from where he retired in 1967. He was offered the position of Emeritus Scientist by the Indian Council of Agricultural Research (ICAR) in 1971.

Later he become Agriculture Advisor to the Government of M.P. For several years he was the Vice-Chairman and Executive Director of the Madhya Pradesh Rice Research Institute (MPRRI) at Raipur.

He represented India at several international commissions. He is the founder of five scientific journals. He is the author of some widely acclaimed books and over 100 scientific papers, containing his original work.

He was elected the President of the Indian Society of Plant Breeding and Genetics in 1959-60, and President of Association of Rice Research Workers in 1978 and again in 1979.

His work in the field of problem oriented and fundamental research on plant breeding and genetics is widely respected. He is a world authority on rice genetics.

He has been engaged actively in the sample collection of reputed indigenous rice varieties with a view to upgrading them

genetically with high yield potential and reasonable resistance to major diseases and pests. He has collected and preserved nearly nineteen thousand indigenous rice types and created a rice germplasm bank at Raipur.

His adaptative rice notes for farmers of Madhya Pradesh have been found invaluable. He has worked on an encyclopedia of rice varieties of M.P. Out of high office also he has continued his dedicated work, at home and at his farm in Sagoni Kala village near Bhopal. He suffered an heart-attack at the time of the Carbide disaster in Bhopal but even after this he has continued his work with tremendous determination and willpower.

Now we come to Dr. Richaria's 'specific plan for action for increase in productivity of rice'. First he identifies the factors which have retarded the increase in rice productivity in recent years despite so much increase in investments in the form of fertilisers, pesticides, irrigation, research, extension etc. Then he gives his plan in brief. Dr. Richaria's plan has three basic components -

(1) rice development to be based on the rich indigenous germplasm which has to be explored further and preserved
(2) a highly decentralised extension approach and
(3) large-scale adoption of clonal propagation technique to spread improved varieties and exploit hybrid vigour.

According to Dr. Richaria (all quotes from the plan) "The main constraint has been the hurried introduction of the undesirable new rice material, the HYVs (dwarfs) on which we based our strategy, replacing even the reputed high yielding rices of the locality, forgetting at the same time unexpected drought situations, under which the HYVs lowered the yields. In addition, under heavy fertilization and irrigation the HYVs proved to be susceptible to diseases and pests which cannot be controlled easily thus again pointing towards reduction of yield. Further, unlike wheat and sugarcane, the concept of 'wider adaptability' in rice has a limited scope for application (not

exceeding 10 per cent of the rice area). This has naturally led to local preferences of different types of rices and socio-economic adjustments, developed in course of time." So, Dr. Richaria concludes, when the base is itself weak (meaning the new rice material) a mansion, built on it must collapse.

At another place in the plan be writes "The most immediate and major cause can be attributed to frequent replacements of the adapted rice varieties in a locality, partly or fully. This is because the agro-ecological balance has been disturbed in the environment in respect of the existing germplasm which had been built up in course of time for centuries by the natural process of empirical breeding and selection establishing ecological balance in different environments, what in modern times can be interpreted as 'ecological breeding' (term coined by a Japanese worker in 1959)."

Fortunately, indigenous high-yielding varieties, adapted to local environment are available in the country. In a survey carried out in Madhya Pradesh between 1971-74, 8 per cent of the indigenous rice types were observed to fall under the category of high yielding types, fixing the minimum limit of 3705 kg / Ha.

In view of this there is a need to redefine 'HYVs' which hitherto have been officially identified only with the exotic dwarf fertiliser - responsive varieties.

At a national symposium on increasing rice yields in Kharif (Monsoon season) held at the CRRI, Cuttack on Feb. 8-11, 78, the rice workers agreed that "the time is now ripe to redefine the term High Yielding Variety (HYV) as a high yielding variety for a particular environment possessing suitable plant-type characters for that condition which may not be suitable for other environments. "A (rice) variety irrespective of its plant and / stature giving significantly higher yield over the local or regional average yield under farmer's condition may be defined as a high yielding variety (HYV)."

To emphasise the point further, the Directorate of Rice Development, Govt. of India, had issued a paper entitled Need

for a National Policy on Rice (1972) and concluded, "The new varieties of rice should be as good as the (current varieties) older ones in local adaptability and some characteristics but not inferior in any character. It is our experience that when we try to recommend a variety which is a compromise between a high yield and some other character in which the local (older) varieties are superior that we run into trouble. We should not over-emphasise yield but should insist upon a minimum aroma and cooking quality as rice is the only cereal which is directly consumed without much change in the form of its grain."

Dr. Richaria recommends strongly, "It is high time that the country's 1964-65 breeding programme which nearly stands suspended to exploit the rice indigenous rice germplasm, is also resumed in the light of the observations, recorded above, when about 445 improved varieties, bred for specific stress situations, showing environmental resistance to diseases and pests were available, and would be still available, in the country. It is not too late and the strategy formulated in this programme, mainly based on our rice genetic resources may be accepted which also contemplates that the indigenous germplasm in its hybridized form (hybrid rices) has also bright future to enhance rice productivity."

Selection work (genetic upgrading) with indigenous rice types was resumed by Dr. Richaria in 1968 after leaving Cuttack "About 1500 improved types (improved versions) and eleven composits were developed and made available by 1978 selected from about 7800 principal indigenous rice cultivars. An approach was to release this hidden production force which remains unnoticed, unrecognised and confined to certain localities with individual growers."

"For high yield potential genetic upgrading of the adapted rice varieties (indigenous rice germpalsm), with certain manipulation, such as the evolution of new hybrids and exploiting hybrid vigours utilizing pure material of local types, is the only course left for speedy recovery of loss, to stabilise rice production at a higher level, instead of waiting to replace our rice by other rice material of doubtful nature which may or

may not get adapted to stabilise yields in the environments under which rice grows in variable situations in India.

The available fertilisers can be very economically utilised with these selected and genetically upgraded rice types, producing more rice per kg. of nutrient, applied at comparatively low levels of fertilization."

In the area of research as well as extension, Dr. Richaria recommends a highly decentralised approach. This, he emphasises, is inherent in the nature of the rice plant. To quote, "If we were to think of a single characteristic feature of the rice plant which yields food for millions, it cannot be anything else but its variability in the form of thousands of its cultivars, spread in India and in other rice growing belts of the world. This is because of the rice plants flexible genetic make-up and mutational power of adaptation." So he recommends the establishment of a wide network of "adaptive rice centres" in all rice growing areas.

"The adaptive rice centres will be the custodian of all local rice cultivers in respective localities, assembled immediately, supplemented if necessary, by the already available materials of the locality at different research centres. They will be maintained under their natural habitat to safeguard the future. They will be known as local treasuries of rice germplasm, (a term suggested by Dr. Frankel of Australia)."

The function of the centres will be:

a) To maintain the evolved rice genetic material for future studies and use as it is practically impossible to retain it in its original form at a central place in India or abroad. It can only be maintained in its original condition at its natural habitat only seeking help of the rice growers themselves.

b) To educate the young farmers to appreciate the value and importance of their own material adding new ones as their hobby.

On the basis of his wide experience Dr. Richaria says "Invariably I found in rice areas some rice growers taking keen interest in their local rice varieties as they are very much

absorbed in them and they have all praise for them, so much so that they trace back the history of individual rice varieties to their ancestry with their utility and such selected and devoted rice farmers will be put in charge of the centres. I also observed that some of them identify their rice varieties in their own way (not in terms of the modern knowledge of Botany) which amount to thousands. This inherent and intuitional facility of selection and maintenance of thousands of rice cultivars gradually being accumulated and descended upon for unknown centuries, ever since the rice first originated must be preserved and exploited for the advantage of the present generation and to ensure the safety of those still unborn."

"On the practical side a beginning may be made in M.P. where upgrade material already exists in the form of about 1500 improved types made from growers' own rice cultivars which can be distributed in different centres for work to be started immediately, to obtain advantage as early as possible and to prepare the hybrid material for the next season." On the basis of his experience in Madhya Pradesh, Dr. Richaria stresses that women will prove to be the most important link in introducing this technology. At Adaptive Rice Research Centre in Baronda, Dr. Richaria noticed that women workers absorb new methods and ideas very quickly. Here he had specially promoted some women workers as supervisors for managing the germplasm of over 17000 rice cultivars in the field and the practice of clonal propagation.

For rapidly spreading improved upgraded varieties and for exploiting their hyboid vigour the clonal propagation technique can give very good results.

This programme is based on demonstration once held on a state-wide scale sometime in 1964 in Orissa by the State Agriculture Department to spread a fine grain non-lodging rice variety CR 1014 for low lands which is still popular in that state and elsewhere.

"It will also be demonstrated that the healthy seeds, obtained by clonal propagation for a full crop of rice to follow, give nearly 20% higher production for any rice variety."

Further hybrid clones for exploiting hybrid vigour can be obtained. Hybridization work will be carried out by the trained field workers of the adaptive centres.

"Whereas clonal propagation in rice as a mean of raising pure seeds to offer 20 per cent higher production and the extension of this technology to exploit hybrid vigour to obtain 50 per cent increased yields, remain unexploited, a great discovery of immense value is left unheeded, in the form of 19 thousand rice cultivars coupled with their 1500 improved versions representing intense variability, assembled from the least understood rice areas of M.P. (Chattisgarh, Bastar, Abhujmal tracts etc. inhabited mostly by tribals."

There should be no further delay in implementing these ideas, specially as Dr. Richaria has warned, "the latest position is that attempts are being made that this indigenous germplasm must vanish with the least possible delay and the step taken is to collect the seeds of indigenous rice varieties from the growers in exchange of seeds of dwarf and semi-dwarf HYVs (to replace them)"

Droughts, Floods and Rice

In a big part of the country the rice crop is ruined by drought conditions and in another significant part by flood conditions. In this context Dr. Richaria's plan is all the more invaluable as it incorporates resistance to floods as well as drought conditions, not to mention disease and pest invasions.

Dr. Richaria's documents of the days of his work at MPRRI in Raipur mention the several drought - resistant indigenous varieties discovered in the course of field - work in Chattisgarh region, and above all the immense diversity of the rice varieties grown. A special advantage of this in distress situations such a drought is that while some varieties suffer, some survive and so yield doesn't go below a certain level.

Regarding flood situation the clonal propagation method offers special advantages. It has been demonstrated that rice clones show resistance to submergence.

9

CLONAL PROPAGATION TECHNOLOGY FOR BREAKTHROUGH IN RICE

The technology of clonal propagation (also known as vegetative propagation) holds out a rich promise for increasing rice productivity. Works on this technology of clonal propagation and on individual tiller breeding has been carried out by Dr. R.H. Richaria, former Director of Central Rice Research Institute (CRRI) and eminent rice scientist, for quite some time, beginning with 1942, but more intensively after 1958 and a series of papers have appeared. Its importance in rice breeding and as a practical means of exploiting hybrid vigors was worked out as far back as 1960.

In a recent book (1987) on this technology titled 'Rice in abundance for all times through rice clones, a possible one grain revolution - a genetic forecast' Dr. Richaria explains the following important benefits of this technology.

1. "Investigations have conclusively established the superiority in grain production of vegetatively propagated plants (clones) over normal seed plants in respect of environmental stress and drought, comparatively non-lodging habit, resistance to diseases, pests, floods and salinity, ultimately to produce more grains per unit area."
2. "There is no other field technology which can allow seed multiplication so rapidly than this method which enables a single paddy grain or a single stubble, multiplied to obtain over forty quintals of grains within ten to eleven months (January to November) depending on the variety utilized and resources made available."
3. "The clonal technology now provides an easy solution to exploit hybrid vigour in rice even utilizing male steriles and semi male steriles of local origin ... The method can be applied to prevent depression in grain yield, caused by intensive inbreeding in a rice variety by employing its eco-types in the crossing programme.

This technique was extensively applied for agronomic, physiological and genetical studies at the CRRI.

In practical terms what exactly is this technology of clonal propagation? The answer is best given in the words of Dr. Richaria himself, "Paddy grains are picked up and put for germination in an earthern pot. They germinate and begin to grow, with two grains. The same two seedlings throw out tillers, after about 10 to 12 days, depending on the season. The tillers can be separated when they are fairly strong, about 20 days after, by carefully detaching them one by one by finger nails preferably by thumb's nail or by a sharp scalpel or razor blade. The separated tillers should be immediately transferred back in the earthern pot which is to be well manured with enough moisture. The individual tillers grow and again produce tillers in varying numbers, every about 15 days after. The process of separation is repeated at intervals, depending on the growth and development of tillers, till the normal time of transplanting reaches in July-August. It is observed that the period of separation (intervals) is very much reduced i.e. the rate of growth is very much accelerated during June-July. Any number of clones can be raised and multiplied from a single seedling or a few of them (if a beginning is made fairly early, say February when the winter temperature begins to rise) transplanted in

July-August to cover an acre of rice field and a füll crop of rice harvested by November to obtain a huge quantity of pure seeds, as stated in some cases, recorded later.

"In this manner, pure seeds can be multiplied by this clonal propagation technology, described above and a normal crop of rice can be raised during the following season from seeds (obtained from the clones) which give higher production than the yields obtained from seed to seed crop. This is mainly because the grains, obtained from clones are fully matured healthy and filled up with the least percentage of chaffy grains. This is also due to physiological efficiency of the tiller plants.

"The individual rice grain can also be a hybrid seed for F1 plant which can be expanded clonally to obtain enough seeds to raise a full rice crop of F2 generation, exploiting remnant hybrid vigour in later generation.

According to Dr. Richaria, from various experiments it was observed that the increased yield, obtained by clonal propagation varied with rice varieties and ranged from 17 to 61 per cent as compared with the culture from normal rice seedlings.

Further, it may also afford some protection from insect pests.

Dr. Richaria gives examples of how any rice variety can be spread rapidly in a rice region within a season by taking advantage of the technology of clonal propagation to take advantage of increased rice production within one or two seasons.

This technology has special use in flood-prone area. At times rice fields get submerged due to floods at an early growth of the crop with the result that replanting is necessary, but in the absence of normal seedlings the rice - fields remain vacant. In such a situation the aged seedlings from the unaffected rice fields in the neighborhood or from any other source can be utilized as a source of clones. Further, continues Dr. Richaria, it has been demonstrated that the rice clones resist water submergence through floods i.e. they show resistance to submergence. They can therefore, be utilized in flood prone

areas for which special nurseries may be raised and aged seedlings may be utilized as a source of clones.

During the main crop season 1963 an intensive effort was made to popularize the technique of vegetative propagation through twenty-five demonstration trials in 10 different villages of the neighboring Cuttack Sadar Stage 11 Blocks. The yield potential of vegetative propagation technique was tested in four improved varieties viz. GEB 24,J.192.T.141 and T.1242 against a local variety.

"Vegetatively propagated crop in general, has given substantially higher yield than the normally raised crop in all the varieties; thus establishing the superiority of this technique."

"Clonal propagation technology provides a special advantage to utilize the clustered - grain rice-type in cross-combinations, to obtain higher production from the combined effect of hybrid vigour through heterosis and intense density of grains of the panicle, besides other desired combinations."

Occurrence of clustered paddy types is not very uncommon, if special efforts are made to locate them especially from places where the rice culture still continues comparatively undisturbed.

Finally Dr. Richaria concludes : "In brief this work may be taken as a genetic forecast to introduce a possible silent revolution in up-grading the yield potential of the rice culture wherever it is practised in over 110 countries of the world in general and India in particular."

In addition in this book Dr. Richaria provides several instances of the remarkable wisdom of ordinary farmers, specially tribal farmers. In fact this booke is dedicated to the tribals of India. Appendixes contain some invaluable papers.

This book can be had from:-

Dr.R.H. Richaria,

B-1, Punjabi Bagh, Govindpura,

BHOPAL (M.P.) India

10

TEXTILE FIBRE FROM LINSEED STRAW

Linseed is an important oilseed crop of India. However, its utility can be increased greatly if some productive use can be made of its straw which is generally wasted. Dr. R.H. Racharia has done pioneering work to produce wealth from this waste, more specifically to manufacture soft textile fibre from linseed straw. Although he has gained fame mainly as a rice scientist, he had infact started his scientific career as the oilseeds specialist of (what was then) Central Provinces.

In the first phase of his work (1937-50) he was able to bring this technology to quite an advanced stage. He summarised this work in a book he wrote in 1950 - 'Wealth from waste-Indian linseed plant from fibre point of view.'

Describing the objective of his work in this field, he wrote:-

"To utilize the existing straw, as it is left over after the threshing process, which is either thrown away as waste material or is burnt as fuel to evolve methods and processes most suited to the Indian village conditions where water supply is limited during the summer months and when the bulk of the straw is made available, to find out different uses of the straw and its fibre to produce articles of common use."

To realise these objectives, experiments were conducted and the results achieved established that the Indian linseed plant, grown for basic seed is also capable of yielding a high

quality fibre which may provide a raw material for the establishment of a number of industries requiring cellulose material, such as the textile, cordage, paper making including cigarette-paper manufacture, artificial silk, nitro-cellulose products etc.

During the course of the work, a number of papers were published and over 1000 exhibits sent out. Sporadic efforts were made to translate the results into practice. Several eminent persons and experts expressed their admiration of the work. The Advisory Committee of the Imperial Council (now Indian Council of Agricultural Research) also recommended these findings to various provincial and State Governments for applying them into practice.

Anugraha Narayan Sinha, Minister of Finance, Govt. of Bihar said "The results achieved, if applied properly would go a long way in meeting the demand of 'soft' fibres in the country."

In 1947 this work was demonstrated before Mahatma Gandhi who promptly asked the Bihar Charkha Sangh to take up the work.

The first attempt to establish a cottage industry unit was made at Nagpur. This was later converted into a bigger Experimental and Demonstration Pilot Plant on the consent of the Central Province Government.

A stage had been reached when the managements were willing to purchase the fibre on a large scale, but in the absence of any organisation for fibre production this could not be achieved.

Interesting work continued to be done in the villages around Nagpur and Sabour (Bihar) for several years. However, three factors intervened in the progress of the work. Dr. Richaria had to take up work as a full-time rice specialist when he was appointed the Director of the Central Rice Research Institute Cuttack. Secondly a fire destroyed much of the work and equipment. Last but not the least, some representatives of the existing cotton textile industry were also suspicious of the new technology.

As far back as 1938, the Director of Cotton Technological Laboratory, Matunga (Bombay), Indian Central Cotton Committee expressed an opinion on a sample of cottonised linseed fibre sent by Dr. Richaria that the fibre would compete with the established cotton industry of the country, if allowed to develop and therefore, work in that direction should be discouraged.

Nevertheless some representatives of industry have continued to show a keen interest in this technology for some time. Some of them even came to borrow Dr. Richaria's old equipment after he had retired from his official work. The relevance of the work continues as before, and the work should be continued in an appropriate way to realise this potential of wealth from waste.

EPILOGUE

It is a pleasant September evening, and a cool breeze wafts in from the monsoon greenery that surrounds the nicely located, friendly looking house of Dr. Richharia. He has just sipped a steaming hot cup of tea served by his daughter, and another cupful of brew he loves so much is secure in the thermos flask placed comfortingly nearly a pile of books on his table.

I've finished all my work of interviewing and taking notes from voluminous books, but a few sensitive points have to be taken up before I catch the night train back to Delhi.

"Yes it is true that I've been very gravely wronged by certain persons in my life, as a result of which great suffering has been caused to me and those dear to me, and what is even more important, work of national importance has suffered greatly, but I do not want you to name any of these persons in your book. For me what is important is that despite all that they did to me, my work did not stop and more and more people have been realising the importance of the line of thinking and work that I pursued."

"But I would certainly like to recall all the people who gave me the strength to continue the long struggles of my life - my father from whom I learnt so much, my mother who gave me the permission to go abroad when so many others objected, my elder brother, his friend who secretly gave me a Rs. 200 so that I could sit in the scholarship exam for going abroad, the young lawyer who fought my case when I was being victimised, whom I blessed while heartedly to rise to the very top of his profession and who is today the Chief Justice of the Supreme Court of India (Sh. Ranganath Mishra) my dear daughter who cares for me so affectionately, in fact all my family members and above all my late wife who stood by me with great courage during the difficult years 1967-1971."

Darkness has descended. I get up to switch on the lights but his gentle hand prevents me. The eminent rice scientist is deeply lost in the memories of 82 eventful years of his life.

Appendix I

Some Important Books of Dr. R.H. Richharia

1. Rice in abundance for all times through rice clones - a possible one - grain revolution - a genetic forecast (1987-88).

2. Rices of Indian (jointly with S. Govindaswami) (1963, 1990). Price Rs. 125.

3. Monograph on linseed (ICAR, 1961).

4. Wealth from Waste - Indian linseed plant from fibre point of view (a new source of textile fibre) (1950).

5. Plant breeding techniques in recent years, 1939.

6. Plant Breeding and Genetics in India (1945, 1957).

7. Breeding high fertiliser responsive varieties with special reference to Indo Japonica hybridization programme edited by Dr. R.H. Richharia.

Note:- The first two books can be obtained by writing to Dr. Richharia' address at B - 1 Govindpura, Punjabi Bagh, Bhopal. India

Appendix 2

This chapter gives the full text of an action plan prepared by Dr. R.H. Richharia for increasing rice production at the request of the Prime Minister's office.

A SPECIFIC PLAN OF ACTION FOR INCREASE IN PRODUCTION OF RICE

By Dr. R.H. Richharia

INTRODUCTION

Inspite of progressive increased area under irrigation and increased use of high yielding varieties of rice, coupled with increased consumption of chemical fertilizers and pesticides, productivity of rice remains stagnant and unstabilised in recent years. The reason is not far to seek. The main constraint has been the hurried introduction of the undesirable new rice material, the HYVs (dwarfs) on which we based our strategy, replacing even the reputed high yielding rices of the locality, forgetting at the same time unexpected drought situations, under which the HYVs lowered the yields. In addition, under heavy fertilization and irrigation the HYVs proved susceptible to diseases and pests which cannot be controlled easily, thus again pointing towards reduction of yield. Further, unlike wheat and sugarcane, the concept of 'wide adaptability' in rice has a limited scope for application (not exceeding 10 percent of

the rice area). This biological force has naturally led to local preferences of different types of rices and socio - economic adjustments, developed in course of time. These considerations explain why rice productivity remains unstabilised and stagnant and calculations did not work. When the base is, in itself, weak (meaning the new rice material) a mansion, built on it, must collapse. In planning too, stress was not laid on improving the inexpensive local resources which matter in agriculture. The stress has been more on making Indian Agriculture 'factory-oriented'. Fertilizers and pesticides are produced in factories which may slow down their production or may remain idle for many reasons and at times transportation may be a problem, leading to interruption in the supply of in-puts in the fields at the proper time. Citing examples of Punjab and Haryana and a few others from resourceful localities in support of the HYVs of foreign blood in rice and working out a strategy to extend them elsewhere, where environments are unfavourable to increase productivity (neglecting the superior HYVs of indigenous origin) have been our main draw-back in our approach and hence this action plan. Any action plan, drawn up for rice, must take into consideration these lapses. Self-generating economy and building up of local resources alone offer a permanent solution in rice and not the outside support which would always be limited, conditional and uncertain. Local resources would also include forestry and animal husbandry (for farm power and soil fertility) to restore imbalance, being created in the environmental ecosystem in the typical rice areas. Organic and ecological farming with which the farmers are familiar and which they prefer, finds little place in our research and planning process after 1965. Location specific approach alone can help us in increasing productivity, tract-wise, village-wise and individual field-wise.

India is gifted with rice climate where environments favour the growth of the rice plant. The crop is grown throughout the year in some parts or the other of the country with suitable rice varieties, upto an altitude, 7000 feet above the sea level and 10 feet below and under rainfall, varying

between 20" and 200". Such a situation offers a great scope to execute any action plan for immediate increase in the productivity of rice, provided it is based on (1) ready availability of resources locally, including the rice varieties and (2) Willingness and natural inclination of the farmers to accept it. The programme drawn up here, solves both of those controlling factors.

The following two factors also assure the success of the plan:

GENETIC PRINCIPLE

If we were to think of a single characteristic feature of the rice crop which yields food for millions, it cannot be anything else unless it be its (1) variability in the form of thousands of its cultivars, spread in India and in other rice growing belts of the world. This is because of the rice plant's flexible genetic make-up and mutational power to adaption. This means the concept of 'wider adaptability' does not work in rice and (2) The rice farmers stick to their own varieties, as they (rice farmers) possess their deep knowledge to harvest a crop even under the most stress situations and they also possess high yielding varieties of their own which are generally not included in extension programmes (a major lapse) e.g., in a survey, carried out in Madhya Pradesh between 1971-74, 8 percent of the indigenous rice types were observed to fall under the category of high yielding types, fixing the minimum limit of 3705 kg./Ha.

A survey has also disclosed that during the past 25 years, the farmers have not left even a single of their high yielding rice varieties but because such types have no place in our extension programme, they remain confined with some growers only and naturally do not produce any marked impact on production.

Rice in one crop which offers a tremendous scope to improve its productivity if this plan is executed with faith and confidence, as it combines both the factors viz., the areas where rice grows are naturally gifted with environments, full of resources, freely available to be developed further as demand

increases and the rice farmers will willingly accept the improved versions of their own varieties (retaining their original names) about which they possess enough knowledge of their environmental and nutritional requirements, their properties and peculiarities and they know them more accurately than what we do, as we have not cared to study them and know them well (except a few). But on the other hand, we have jumped on to other material, least investigated, in the environments where it is introduced as a blanket recommendation, as HYV programme with dwarfs during the past two decades. Not surprisingly, therefore that rice productivity remained stagnant and will continue to do so, if this HYV programme is not suitably modified. This action plan visualises this aspect of the problem. It envisages a direct approach to the rice farmers who are the real masters of the subject and to utilise their experience and practical knowledge of their own material to produce more, opinions may differ, but as other approaches have failed to increase and stabilise rice yields, this plan deserves a chance, a serious consideration and immediate implementation. There is no possibility of its failure, being exclusively associated with the adapted rice germplasm of known origin and heredity which has sustained humanity and their culture for centuries, in the South-East Asia and parts of Africa with added advantage that it responds to the application of modern production technology as well, with variation within limits. In action it will be rice farmer's own movement on a war footing, (as when a war is wedged against an enemy there is no question of money, involved. Here the enemy is stagnant and unstabilised yields). I predict, this action plan shall succeed, provided it is viewed unbiased, not calling it antiquated or impracticable or nothing new in the plan or because it originated from a certain quarter, it must fail etc. This much modification will be justifiable that the plan may be implemented in phases, locality-wise.

JUSTIFICATION

Main causes of stagnation in rice yields particularly during the past two decades have to be understood and removed to

increased productivity in rice, knowing fully well that many parts of rice regions of India are gifted with rice climate to giver record yields to lead in South-East Asia. The most immediate and major cause can be attributed to frequent replacements of the adopted rice varieties in a locality, partly or fully. This because the agro-ecological balance has been disturbed in the environment in respect of the existing rice germplasm which has been built up in course of time for centuries by the natural process of breeding and selection by farmers, establishing ecological balance in different environments, what in modern term can be interpreted as 'ecological breeding', a term coined by Japanese workers in 1959. (It necessarily involves location specific breeding research). This balanced rice material under cultivation, not only possesses high yield potential (see Table I & II for example) with many other advantages, if handled scientifically, but is also capable of being responsive to a reasonable application of modern production technology and fluctuating environments, besides a good level of resistance to environmental stress and common diseases and pests, coupled with local preference for palatability in rice areas (also referred to later). This is being disturbed which delays progress. A gradual increase in productivity would have become a regular feature, if this balance was not disturbed and a simple programme of genetic upgrading of the indigenous cultivars were undertaken. But an approach initiated in 1964-65 to replace 'indigenous' type (which are also termed as 'traditional') calling the indigenous varieties as traditional is misleading, as tradition denotes something stationery, firm and not changing. On the other hand the indigenous varieties move with the changing environments by mutation and get adapted by nature process, based on the principle of 'ecological breeding'. The rice varieties which existed in 400 B.C. during the Charaka and Susruta period are not the same now, although the major characteristics may not have changed by the least known exotic rice germplasm and at the same time engaging the attention and diverting the energy of our brilliant rice breeders in that direction, has created problems which are

confusing us. There are also accepted by top most rice researchers of the country, referred to below.

Thus we must learn lessons from the failure of the two major rice breeding programmes during the past three decades viz. (i) the indica x japonica hybridization programme (1950-65) and (ii) the introduction of foreign rice variety Taichung (Native) I, in 1964-65, and the release of the miracle rice IR 8 in India in 1966. The top most plant breeders of the country who assembled at the Central Rice Research Institute of Cuttack in 1979 under the 'Task Force', appointed by the Indian Council of Agricultural Research for the discipline of 'Rice Breeding' concluded as follows : Most of the HYVs are the derivatives of T(N)I or IR8 and, therefore, have the dwarfing gene of Dee - geo - woo - gere (DGWG). This narrow genetic base has created alarming uniformity, causing vlnerability to diseases and pests. Most of the released varieties are not suitable for tropical uplands and low lands, which together constitute about 75 percent of the total rice area of the country. To meet these situations, we need to reorient our research programmes and strategies'. It is significant to record what Mr. R.B. Sen the then Director General of Food and Agricultural Organization of the United Nations Rome, as far back as 1966, had given a warning in this connection. It was a prediction which took about 15 years to establish it (c.f., Septeınber, 1966 special No. Indian Farming I.C.A.R).

The programme presented here takes into account these facts to prevent further deterioration and strategies have been worked out to ensure steady progress on the rice front.

Besides the re-orientation of the programme, already drawn up by the 'Task Force' in 1979, it is high time that the country's 1964-65 breeding programme which nearly stands suspended to exploit the rich indigenous rice germplasm, is also resumed in the light of the observations, recorded above, when about 445 improved varieties, bred for specific stress situations, showing environmental resistance to diseases and pests were available and would be still available in the country. (Richharia & Govindaswami, 1966). To emphasise this point of view yield

potentials of these rice varieties under normal soil fertility level are recorded in Table I (Column 2) to compare them with the average productivity in some major states as reported in 1980-81 (Table I column 3) when an exclusive all out drive for HYVs of dwarf and semi-dwarf plant type (about 140 in number) was made for large-scale cultivation for different agro - climatic conditions in recent years. It conclusively points to the adverse effects of modern HYVs in rice productivity. This stagnation in rice productivity could have been avoided with a little foresight and vigilance, the danger of which was already predicted. It is not too late and the strategy formulated in this programme mainly based on our own rice genetic resources, may be accepted which also contemplates that the indigenous germplasm in its hybridized form (hybrid rices), referred to later has also a bright future to enhance rice productivity

Table 1. Yield Potentials of Indigenous Rice Varieties of India

Sr. No.	States	Productivity Potential (Kg/Ha) prior to 1964-65 or 1960	Actual Productivity (Kg/Ha) in 1980-81
1.	Assam	1840 - 4140	1109
2.	Andhra Pradesh	1680 - 4820	1978
3.	Bihar	2060 - 2300	997
4.	Hyderabad	2240 - 2370	-
5.	Madhya Pradesh	1390 - 2860	334
6.	Madras (Tamil Nadu)	2020 - 5600	1882
7.	Orissa	1120 - 4490	1031
8.	Travancore Cochin	2240 - 3140	-
9.	Uttar Pradesh	2240 - 3370	1049
10.	West Bengal	2240 - 4140	1442
11.	Gujarat (Bombay)	1400 - 3500	-
12.	Maharashtra	-	1570
13.	Haryana (Old Punjab)	2240 - 3030	-
14.	Punjab		2736

Selection work (genetic up-grading) with indigenous rice types was resumed by the author in Madhya Pradesh in 1971 in order to re-establish the superiority of the existing rice material as a reminder that the materials not traditional, but dynamic and about 1500 improved types (improved versions) and eleven composites were developed and made available by 1978

selected from about 780 principal indigenous rice cultivars. An approach was to release this hidden production force which remains unnoticed, unrecognised and confined to certain localities with individual growers. A strategy was worked out in 1974 on the rice production front in Madhya Pradesh as explained in an Adaptive Rice Research Note No. 5 and the conclusion drawn was as follows: "There are many most-adapted, high yielding indigenous rice varieties existing in Madhya Pradesh which resist the attack of diseases and pests in the main season. Many of them are also capable of producing still higher yields, when grown during the summer months. This discovery awaits exploitation intensively when the agricultural in-puts (mainly the chemicals) are in short supply. The available fertilizers can be very economically utilized with the selected and genetically up-graded rice types, producing more rice per Kg. of nutrient, applied comparatively at low levels of fertilization' (Richharia, 1974).

But the work had to be closed down, as the M.P. Rice Research Institute of Raipur (a registered body) where this work was being continued was abolished and the specific items of work, aiming the increasing the productivity of rice were stopped. With the knowledge of world collection of rice germplasm which the author possessed as Director of the Central Rice Research Institute (Cuttack), he had made an attempt with the help of this rice germplasm to lead India in rice productivity in the South-East Asia, as he found many peculiarities in this material in high frequency, not ordinarily observed in the available world collection. It was rightly observed once by some on that 'He who controls the supply of rice will control the destiny of the entire Asiatic ORBIT. The most important thing to the majority of the people of Asia is not capitalism or socialism or any other political ideology but food which means life itself, and in most of Asia food is rice'. Prof. Calder Smith of Edinburgh who travelled to S.E. Asia on an FAO assignment observed in his article, 'The starving millions' which appeared in 'New Scientist' somewhere in 1964, that where he went in the region, he found people hungry and

the reason (he attributed) was human fertility. Obviously he was hinting at population explosion. This observation further emphasizes the necessity that India, a premier rice growing country in S.E. Asia with ample natural resources, has to move fast to meet the situation.

As already recorded elsewhere, India is gifted with rice climate and is capable of feeding millions in Asia, yet unborn, provided we apply our originality to take advantage of Nature's gift and of gifted rice researches of the country, allowing them absolute freedom of work, uninterrupted and uninterfered. This aspect may also be taken as a part of this programme.

CRITICISM OF THE PLAN

It may be argued that there is nothing new in the plan. It only visualises the exploitation of the existing types only. But from my point of view, there is every thing new, as these indigenous types have not been properly studied and exploited in the light of modern genetic approach and there is no risk involved in this material which stands stabilized in the environment. Progress is to be judged in increase of rice productivity and not in the introduction of new high yielding varieties for the sake of introduction only. New ideas or criticism is not the monopoly of a selected few. It may come from any quarters. A silent opposition of the new HYVs is from the man behind the plough.

I am not the only man who has discovered the importance of the indigenous rive forms and the role played by the rice farmers. In appreciation of the Indian cultivators and their intimate knowledge of the rice varieties, Sir George Watt in 1891 observed as recorded below:

'It must in fact, be admitted that we have to fall back on Dr. Buchnan Hamilton's idea that the chief differences between the thousands of farms of cultivated rices, hinge on their properties and peculiarities under cultivation. These peculiarities the Indian Cultivator, through the time - honoured practices of his ancestors, is able to recognize far more accurately than botanical science has as yet been able to

explain. He determines the suitability or otherwise of this form and that to its contemplated environment with a degree of confidence quite inexplicable (Oryza - 1979, Vol. 16(1).

This further strengthens our approach, why in this specific plan of action rice farmers are associated directly who possess intimate knowledge of their rice varieties on which they may prove good associates, even to guide us with their inherent gift.

It is evident from the multitude of names of varieties, gradually originating from their wild ancestors, coupled simultaneously by selection for local adaptions made by the growers, who have played the role of plant breeders ever since its cultivation first began in India over 7,000 years ago.

Table 2.

Potentials of some high yielding varieties of Indian rices with special reference to MP

Sr. No.	Original Rice variety	Improved versionNo.	Paddy Kg/Ha	Rice Grade	Maturity
1.	Lalloo	Bd. 12	7024	Medium fine	Early
2.	Dhour	Bd. 23	6136	Medium fine	Early
3.	Koyalari	Bd. 811	7350	Coarse	Early
4.	Nungi	Bd. 813	7623	Coarse	Early
5.	Cross 116	Bd. 30	4000	Coarse	Medium
6.	Kalam	Bd. 368	5510	Medium fine	Medium
7.	Beni Kath	Bd. 452	4080	Short fine	Medium
8.	Tedhi Banko	Bd. 207	6290	Long fine	Late
9.	Kala Mali	Bd. 108	7600	Coarse	Late
10.	Safri	Bd. 200	5520	Medium	Late
11.	Dubraj	Bd. 153	4958	Medium fine	Late
12.	Tedhi Banko	Bd. 207	6250	Long fine	Late
13.	Kariya Chini	Bd. 366	5550	Medium fine	Late

Such types can be listed for other rice growing states.

A special advantage associated with this indigenous high yielding rice germplasm identified for different tracts and situations, is that it possesses a good level of resistance to

environmental stress and common diseases and pests, coupled with local preference for palatability.

A SPECIFIC PLAN OF ACTION

An Approach

From the foregoing write-up, it is evident that we must re-orient our strategies particularly in the light of the observation made by the Prime Minister and I am putting forth a specific plan of action for increase in production of rice, based on my work and long experience, keeping in view the recommendations of the rice scientists. The salient points in the plan of action to ensure speedy increase in production of rice are:

1. Decentralized and direct approach to the rice farmers and to take them into confidence and associate them fully.
2. Working with the farmers with their own rice varieties about which they themselves know enough, so that they feel at home, employing simple field techniques in terms of the latest production technology.
3. Creating a sort of movement for increased rice production, including areas where rice is not a major crop, the non-traditional areas, as an additional crop, as a catch-crop.

For high yield potential, genetic upgrading of the adapted rice varieties (indigenous rice germplasm), with certain manipulations, the evolution of hybrid rices and exploiting hybrid vigours and utilizing pure material of local types, are the only course left for speedy recovery of loss, to stabilise rice production at a higher level, instead of waiting to replace our rice by other rice material of doubtful nature which may or may not get adapted to stabilise yields in the environments under which rice grows in variable situations in India. In fact in every rice growing locality, the growers themselves tell us which of their own varieties are high yielding to which they stick. In a survey in M.P. (1971-74) it was disclosed that the farmers have not left a single of their high yielding varieties during the past 25 years, referred to earlier. But under the extension services,

the definition of high yielding rice variety is different which necessarily involves a dwarfing gene and, therefore, growers' own high yielding varieties are not recognised which are estimated to be 8-9 percent in M.P. The result is that ultimately the rice productivity suffers. The specific plan of action naturally has to be drawn up to create an appealing movement in the rural area giving the growers a free hand in the choice of their own high yielding varieties with which they are well versed and they know all about them and their performance, even under the environmental stress. They would naturally demand improved seeds of their own varieties which can be supplied from the adaptive centres, mentioned below.

Establishment of Rice Farmer's Adaptive Rice Centres

It is a suggested that rural adaptive rice centres (to be known as farmers rice centres (Kisani Dhan Kendra) may be established, as many as possible, all over the country, with 2-3 acres (about one hectare) of land for each centre, made available by the growers themselves, so that they consider that it is their own work. Once they realise the usefulness of such centres, they will themselves come forward and the movement will become an All-India movement. To start with, a limited number of such centres may be established in selected localities in every rice growing state with the co-operation of the local rice growers. They will spread by virtue of their utility, as the growers themselves would demand their establishment. The possibility of linking those centres with the nearby rice breeding centres and research stations for mutual advantages may be considered.

Invariably I found in rice areas some rice growers taking keen interest in their local rice varieties and as they are very much absorbed in them they have all praise for them, so much so that they trace back the history of individual rice varieties to their ancestry with their utility. Such selected and devoted rice farmers will be put in charge of the centres. I also observed that some of them would identify their rice varieties in their own

way (not in terms of the modern knowledge of Botany) which amount to thousands. This inherent and intuitional faculty of farmers in selection and maintenance of thousands of rice cultivars, gradually being accumulated and depended down for unknown centuries, ever since the rice first originated, must be preserved and exploited for the advantage of the present generation and to ensure the safety of those still unborn.

Each rice centre will, therefore, be in charge of an enlightened and willing rice grower who will have under him a willing (paid) intelligent field worker, selected from the same locality and fully trained in modern production technology (a combination of indigenous and modern approach) and two farm labourers. Arrangements will have to be made for two roomed accommodation on a payment basis. The rice grower may also be offered some honorarium for incentive, if he desires to accept it.

Programme Of Work

1. The adaptive rice centres will be the custodian of all local rice cultivars in respective localities, assembled immediately, supplemented, if necessary, by the already available materials of the locality at different research centres. They will be maintained under their natural habitat to safeguard the future, an international approach. They will be known as local treasuries of rice germplasm, a term suggested by Dr. Frankel of Australia. In course of time those farmers' centres may be further expanded to embrace varieties of other crops of the surrounding locality with a similar programme, (also to serve as a local gene bank).

It may be of interest to record that during our survey in the Chhattisgarh area we came across rice growers in the remote area, maintaining a large collection of rice varieties, year after year, associated with local customs. This also explains how thousands of varieties are being decended down for centuries. Naturally such collections served as 'Local treasuries', but in the absence of an organisation to encourage such private endeavours, the valuable rices are fast disappearing, due to deliberate attempts. That this valuable

rice germplasm is vanishing rapidly is known e.g., in a locality in Raigarh district, situated in Chhattisgarh, the rice bowl of M.P., there existed about 50 years ago many rice varieties, as the record indicates, but we could collect only 57 types so far. Thus the fact remains that very valuable national wealth in the form of hundreds of valuable rice types has been lost. Thus the functions of the Centres will be:

1. a. To maintain the evolved rice genetic material for future studies and use, as it is practically impossible to retain it in its original form at a central place in India or abroad. It can be maintained in its original condition at its natural habitat only, seeking help of the rice growers themselves.

b. To educate the young farmers to appreciate the value and importance of their own material, adding new ones as their hobby. There already exists a practice in some tribal areas that once in a year at the beginning of the rice crop season samples of rice varieties are brought before a religious Head-man in a village who counts them and by some procedure predicts that particular rice varieties would perform well during the ensuing season. Farmers then give preference to those types only according to the situations to their fields for large-scale production. Such bases would be further strengthened and centres established.

2. The rice growers in general stick to cultivate their own indigenous rice varieties. If the improved seeds of their own varieties by simple selection method (to be done by the trained worker and the nearby local research centres may also do) are offered to them, under their original names, they will gladly accept them (large number of such improved selections are already available for Madhya Pradesh, about 1500). They will be distributed from the centres in small quantities and the farmers will be explained how to multiply them rapidely by clonal propagation method which will be demonstrated to them at the centre. This programme is based on a demonstration once held on a state-wide scale somewhere in 1964 in Orissa by the State Agriculture Department to spread a fine grained

non-lodging rice variety CR 1014 for low lands which is still popular in the state and elsewhere.

3. It will also be demonstrated that the healthy seeds, obtained by clonal propagation for a full crop of rice to follow, give nearly 20 percent higher production of any rice variety.

HYBRID CLONES FOR EXPLOITING HYBRID VIGOUR

Hybrid clones of F1, plants between the cultivars or ecotypes of a major/popular rice variety will be distributed among the growers for raising seeds for F2 generation by clonal propagation technique to raise a full crop of rice by their usual methods in the following season for taking advantage of hybrid vigour. Enough information on the subject is available (Clonal propagation technology has been described in detail in a recent publication, entitled 'Rice in abundance for all times through rice clones' by the author - All India Press, Pondicherry, 1987) F2 population, under field condition gives, on the average, 50 to 60 percent higher production, as compared with the parents, depending on the varieties employed. As regards adaptability of the recobinants in local environments, they will behave in the same manner as their parts. The rice growers are intelligent enough to practice any method, once they are convinced that by a certain practice, they can get higher productivity, as they are not afraid of manual labour. Hybridization work will be carried out by the trained field workers of the respective centres (Actually at the Rice Research Stations, who does this work?: the trained fieldmen or the trained and experienced farm workers. Rarely, however, the plant breeders themselves also do it. The same situation applies to the farmers adaptive rice centres, proposed here).

Broadly putting it, from the point of view of a farmer, the following characters are important for maintaining a rice variety : (1) uniform maturity (2) uniform hull - colour (3) uniform crop height (4) uniform length and breadth of the grain by the naked eye and (5) rice colour: red or white. On cooking he is also particular about palatability and aroma. He

has other inherent faculties to distinguish one variety from the other one (with similar field characteristics), difficult to understand.

Since the work will revolve round the local indigenous rice types, the rice growers will naturally take keen interest in this development.

The agronomic practices such as biasi, rotation of crops, mixed cropping, will remain common and will not be disturbed, emphasis being on the use of organic manures, such as compost, green manure, neem cakes and oil cakes etc. The use of nitrogenous fertilizers at lower doses of 20 kg/ha has been found to give higher yields in indigenous types with higher return of grain per kg. of nitrogen, applied in general. Economic use of fertilizers is thus also assured, if desired wherever the growers are responsive, this will be practiced. The latest designs of bullock-drawn and hand-drawn machines will be used which will serve as a demonstration, including hand transplanters. The use of power-driven tractors in preparing rice fields for transplanting paddy seedings, wherever possible will be practised.

It may be questioned. Will the rice cultivators absorb and follow up these methods which apparently seem complex particularly item (4) of the programme of work? The answer is that during our extensive survey of the rice regions of India, we observed that the rice farmers have been following more complicated systems to keep their rice culture vigorous and maintaining their thousands of rice varieties from time immemorial.

5. A portion of the land will be utilized to demonstrate the utility of ecological, organic and agro - forestry - farming with local resources, keeping in view the socio - economic conditions of the farmers.

6. Farmers in informal discussions express original ideas, which, if seriously considered, prove very useful, practical and inexpensive in relation to their environments. The centre will thus function as a forum to expose the genius of the rural masses. Original thinking is not necessarily the monopoly of

university degree holders. At some places I have also observed some agricultural scientists who have settled down on land after retirement do location specific work and have made valuable contribution to help the surrounding farmers.

CENTRES OF ACTIVITIES AND HEAD QUARTERS

I will devote all my time and energy and apply my knowledge and experience with my headquarters at Bhopal. Rice grow in the surroundings of Bhopal. There is also a Central Institute of Agricultural Engineering with a big farm, attached to it (the Nabibag farm) where rice can grow, as I worked on this farm. One adaptive rice centre can also be initiated here where it can also be demonstrated that rice can be taken as a catch crop in wheat fields which remain fallow during the monsoon season in Malwa region. Enough knowledge and material already exist on this subject, as two rice research sub-stations of Madhya Pradesh Rice Research Institute worked for three years in Malwa region viz., (1) at the Agricultural Farm, Fanda and (2) at the Agricultural Farm, Sconi Malwa, till recently.

As an alternative, some farmers will come forward willingly to extend facilities to implement this programme of action in the Malwa tract of M.P. There may be similar situations in other states as well. Establishment to other centres will be a follow-up action.

TRAINING CAMPS AND DURATION

One training camp will be organised immediately and workers will be trained partly at Bhopal and partly at the adaptive Rice Research Centre at Baronda (Raipur) where the rice germplasm, covering 19 thousands rice cultivars are grown under the farm University. Since it is proposed to establish ten farmers adaptive centres in M.P. and one such centre in every rice growing state, the total numbers of trainees will be 22 From eleven rice growing states (two from each state) 20 From ten centres in M.P. (Two from each centre) 42 Total.

These trainees will form the nucleus for further development to multiply farmers' rice centres when a natural demand increases.

I may add that I am continuing my work on this new technology privately at my farm near Bhopal and three places in other States in India and also in Thailand, Indonesia and the Philippines (latest position). I will place all my private resources at the disposal of this action plan, if required.

Duration of Training : This will be for a period of four weeks (two weeks in July and two weeks in September).

NOTE

The national and State Seed Corporations may, in due course, come forward to take up the hybrid seed production work within some popular high yielding indigenous cultivars, when the demand of such seeds increases. The agriculture departments may also utilise their demonstration farms for this purpose.

CHARACTERISTICS OF HYVs OF RICE

A CHANGE IN THE ATTITUDE OF EXTENSION SERVICES REQUIRED

A change in the attitude of extension workers of the Departments of Agriculture in the rice growing state is to be brought about, in respect of recognising a high yielding rice variety for a particular tract, as the concept of 'wider adaptability' in rice has a very limited scope in India, (except the special situations, such as the flooded and deep water areas where a limited number of special types would serve the purpose) unlike - in terms of, say wheat and sugar-cane. At a national symposium on increasing rice yields in Kharif (Monsoon season) (Held at the Central Rice Research Institute, Cuttack (Orissa) in February 8-11, 1978) the Rice workers of India agreed that the time is now ripe to redefine the term 'High yielding varieties' (HYV), as a high yielding variety for a particular environment, possessing suitable plant type characters for that condition may not be suitable for other environments 'A (rice) variety, irrespective of its plant type and

stature, giving significantly higher yield over the local or regional average yield under farmer's conditions may be defined as high yielding variety (HYV).'

To emphasise the point further, the Directorate of Rice Development, Government of India, had issued a paper entitled 'Need for a National Policy of Rice (1972)' and concluded that 'The new varieties of rice should be as good as the (current varieties) older one in local adaptability and some characteristics but not inferior in any character. It is our experience that when we try to recommend a varicty which is a compromise between high yield and some other character in which the local (older) varieties are superior that we run into trouble. We should not over emphasise yield but should insist upon a minimum level of excellence in respect of all other characters, including aroma and cooking quality as rice is the only cereal which is directly consumed without much change in the form of its grain.'

To emphasise this point, a strategy was also worked out for M.P. In 1974, based on our work with indigenous rice varieties, already catalogued (c.f.), Our strategy on the Rice Production front in Madhya Pradesh - IADP Press - Raipur (1974).

It is thus evident that the specific plan of action, drawn up here, is based on facts, acknowledged by rice workers of India and accepted by the Directorate of Rice Development Govt. of India and I.C.A.R. through C.R.R.I. Cuttack. Success of the plan, if implemented, is assured to increase productivity of rice, before long, as it is backed by scientific facts and experience.

IMMEDIATE STEPS FOR ACTION

If the I.C.A.R. or the Directorate of Rice Development, Government of India or both and the IGKVV, Raipur (M.P), decide to implement the programme, described here, they may depute an experienced rice breeder especially to deal with this plan of action who may contact me at Bhopal to work out further details, or a meeting may be arranged at New Delhi for further details and clarification between the D.G. (ICAR), the Director of Directorate of Rice Development and myself.

A beginning can be made in M.P. where upgraded material already exists in the form of about 1500 improved types, made from grower's own rice cultivars which can be distributed in different centres for work to be started immediately, to obtain advantage as early as possible and to prepare the hybrid material for the next season. In this case, the entire rice germplasm with staff (germplasm associates and field workers trained by me) and records will have to be transferred under this plan of action with my technical control only. This germplasm collection embraces very valuable rice varieties which, if properly studied, would prove very useful to increase productivity and which are to be spread at breeding centres all over the country under this action plan. To quote some examples, the clustered and poly - embryonic rice varieties, early maturing and scented types with high yield potentials and rices showing high protein contents etc. Some of them show excellent combining ability for exhibiting high hybrid vigor, a phenomenon demonstrated long back in rice. A special significance is attached to this material, yielding better under stress situations and showing environmental resistance to diseases and pests. Further, immediate arrangements may be made to hold training camps.

FINANCIAL REQUIREMENTS AND ARRANGEMENTS

If this action plan is accepted in principle, the financial aspect may be worked out in consultation with the undersigned for which an officer may be deputed. On a broad basis the following facilities will be required:

1. The rice germplasm in the form of 19 thousand rice cultivars with records and the services of the members of the staff especially trained for the purpose (the germplasm Associates) may be made available to me with immediate effect to take advantage of the ensuing season for technical work only.

2. Services of one rice breeder in every rice growing state may be obtained on deputation. He has to be a local person

who is well versed with the rice areas and the local rice varieties of the state, so that he is able to prepare the material during the ensuing rice season and at the same time i.e. establishes a few adaptive rice centres on the growers' holdings which may be multiplied, as the demand increases. He will require some contingent grant for field work and T.A. Grants.

3. Adequate arrangements for my rapid mobility with my headquarters at Bhopal will have to be made, services will be honorary. I will not get myself involved in any type of administrative work except the technical control and guidance.

4. An ad-hoc grant may be earmarked and placed at the disposal of a competent authority with wide powers at Bhopal who will draw and disburse funds on my recommendations.

The Director of the I.C.A.R.'s Central Institute of Agricultural Engineering, located at Bhopal may discharge this function through his accounts section. The cooperation of this Institute in implementing this action plan in this part of the country, if extended, can prove useful, so also similar ICAR Centres, located in different parts of the rice regions.

For each Farmer's adaptive rice centre the following expenditure will be needed for the first year:

One field worker,

Two farm labours,

Field Equipment,

Contingency for farming (one hectare),

Accommodation.

During the first year, ten centres will be established in Madhya Pradesh and one in each of the rice growing states (eleven). Thus in all there will be 21 adaptive rice centres.

A GREAT DISCOVERY REMAINS UNEXPLOITED AND UNHEEDED

Whereas, clonal propagation in rice as a means of raising pure seeds to offer 20 percent higher production and the extension of this technology to exploit hybrid vigour to obtain 50 percent increased yields, remain unexploited, a great

discovery of immense value is left unheeded, in the form of 19 thousand rice cultivars, coupled with their 1500 improved versions, representing intense variability, assembled from the least understood rice area of M.P. (Chhattisgarh, Bastar, Abhujhmad tracts etc.), inhabited mostly by tribals. It hardly needs any emphasis to record that the basis and success of all crop improvement work is the crop variability, natural or induced, the former being least time consuming and in all such biological fields, India is the richest and the country offers a great scope towards progress. From this point of view the assembled rice germplasm which combines world genetic variability is naturally the richest wealth for the entire South-East Asia. In support of these facts a list of records of the rices (only a fraction), indicating richness of variability, is attached. Whereas this has not received due attention even in its home state (M.P.), its significance has been recognized outside at the International Rice Research Institute of the Philippines where it is being transferred, after the initiative taken by the World Bank who offered 4.5 crores of rupees with a major condition to close down the M.P. Rice Research Institute where this work was originally conducted and the material be passed on to IRRI as a later development. The latest position is that attempts are being made that this indigenous germplasm must vanish with the least possible delay and the step taken is to collect the seeds of indigenous rice varieties from the growers in exchange of seeds of dwarf and semi-dwarf HYVs (to replace them) which is against the recommendation of the top Indian rice scientists. This is a serious lapse. The specific plan of action aims at preventing further deterioration in productivity and production of rice in India, taking into consideration all facts. It is also my intention and recommendation to leave behind a complete record of this valuable rice germplasm for the use and information of posterity on the lines done in 'Rices of India' (Richharia and Govinda Swami, 1966) with their conservation by the growers themselves, as suggested elsewhere.

A list of records in support of richness of the existing useful rices for rice regions of M.P. with prospects of extension to other rice regions in presented below:

1. Gurmatia Group of Paddy in Madhya Pradesh. (September, 1973) (English and Hindi)
2. Gangai Pest of rice in Madhya Pradesh, Gall-Midge, Pachydiplosis oryzae Wood-Mason (November 1973).
3. Safri group of Paddy in Madhya Pradesh (November 1973)
4. Chudi group of paddy in Madhya Pradesh November (1973)
5. Our strategy on the Rice Production Front in Madhya Pradesh (1974)
6. Progress towards up-grading the Madhya Pradesh Rice Culture for high yields potential (1975).
7. Early maturing rice varieties for Madhya Pradesh (1975)/Revised 1978).
8. 'Hamari Dhan Sampada' (1976) (Hindi Version).
9. Increasing Paddy Production in the environment of Madhya Pradesh (1976).
10. A strategy for Rice production to ensure sustained growth in Madhya Pradesh (1977).
11. Madhya Pradesh ke vathavaran anukul chuni hui vipul utpadan dhan ke lokapriya kismae 1977.
12. Adhik utpadansheel shigra paknewali dhan ke kismae, Lal ssumuha mai BD:2 (December 1977, Hindi Va English)
13. Viphul utapadan ke aur vikas khand, Abanpur (January, 1978).
14. Dhan utpadan, (January, 1971)
15. Variability in rice grades, a series (1976-78).
16. A list of improved rice varieties (new Version) evolved in Madhya Pradesh for extension (1978)
17. Encyclopedia of Rice Cultivars in Madhya Pradesh Geographical distribution Vol.I. (A manuscript only in personnel custody on which my work continues to appear in a number of Volumes).

18. An aspect of Genetic Diversity in Rice Oryza, 1979 Vol.16(1).

CONCLUSION

A strategy on increasing rice production was first drawn in 1974, but it received no attention. The other two programmes viz (1) indica x japanica hybridization programme and (2) the plant type concept met with little success, as they did not remove the main constraint. Thus a very valuable period of about two decades has been lost and deterioration in rice productivity and production in many of the rice regions has been brought to light. A latest release of F.A.O. indicates shortfall in India's paddy production. This organisation has provisionally estimated India's paddy production in 1982 at 68 million tones which is 12 million tonnes less than the output in two previous years.

The present action plan again emphasises the importance and significance of 1974 strategic programme with some additional techniques, based on intensive field research. It is hoped that it is again not side-tracked by attending some other programme to lose more time, thereby creating more constraints.

Such announcement as exploiting hybrid vigour through male sterile lines and a rice variety 126-3, recently reported to have yielded 7 tons of rice per hectare maturing in 105 days etc., can be left with the Rice Research Centres and Post-Graduate Departments of Agricultural Universities for further investigations, as their research pursuits.

'Wide adaptability concept' in rice does not work in 90 percent of the rice hectarage in India.

In brief if this specific plan of action is implemented which involves a direct approach to rice farmers to improve the productivity of their potentially high yielding rice varieties with simple technology, well within their limited resources, the entire rice germplasm of India can be gradually raised in productivity, by upgrading it genetically which will also be preserved for posterity. There is no other shortcut to stop this

deterioration in the rice productivity which was 800 kg/ha in 1970, which going down to 652 kg/ha, a decade later in M.P. now.

A sort of rice revolution movement is to be launched to awaken the rice farmers, to become a permanent feature, as a chain reaction, to increase productivity in rice with the least possible delay. The Indian rice farmer (so also the farmers of other S.E. Asian countries) is not afraid of manual labour and he is most efficient in rice farming. We have little to teach him by way of agronomy. On the other hand, rice researchers may derive new ideas and get themselves benefited immensely from his practice and culture, provided they get themselves drenched with him (the farmer) in rice soils during the growth period. I have done it. Inherently and intentionally experienced rice farmers of their age acted as rice breeders, responsible for developing and maintaining thousands of rice varieties up to our times.

Significance of Rice as Food in South-East Asia and India's Lead Essential

The story of this specific plan of action will not be complete if I do not record the following observation made by some authority for information of the Prime Minister.

'Agriculture and rice or food and rice are synonymous in the languages of China and India.' Rice is a key to the main problems of survival in many of the over crowded areas in the Asian World.

'He who controls the supply of rice will control the destiny of the entire Asiatic orbit. The most important thing to the majority of the people of Asia is not capitalism, or socialism or any other political ideology but food which means life itself, and in most of Asia, food is rice.'

Planning for increase in production of rice, therefore, is a very sensitive subject which attracts the attention of the highest powers in the world, lest India controls Asia on the food front. It is rightly said, 'Vigilance is the prize of liberty'.

India is gifted with rice climate and is capable of attaining supremacy in this biological field and in capable of feeding millions in Asia, provided we apply our originality to take advantage of Nature's gift and allow the gifted rice researchers with absolute freedom of thought and action and do not interfere with the farmers choice of their varieties which possess hardiness and adaptability to their environment and environmental stress and which may be further improved. It is also known that some rice varieties of India have been proving very useful in breeding programmes in raising the yield potential of rice of temperate regions in the South-East Asia to improve the Japanica Varieties e.g. the yield potential of rice in Korea has been increased through such a programme. Such a lead can be further strengthened if the rice germplasm of India is well preserved, studied and supplied directly to countries in the temperate region from the natural habitat, an item to be included in this specific plan of action.

The process of importing rice (A latest report indicates that 70,000 tones of rice is to be imported from Thailand - The Hindustan Times, dated 24.6.83) is to be stopped and the all round deterioration in rice yields and production is to be arrested immediately, This is possible provided the attitude of the planners and of the extension services in the states gets revised and changed in the light of the proposed programme for which bold steps are called for without any type of interference, to avoid further risk on the food front.

Appendix 3

The issues raised in this book can be properly appreciated only within the framework of the wider problems of farm research in India. This chapter therefore deals with the general problems of farm research in India.

WHAT AILS FARM RESEARCH

"Every thing is not well with the ICAR research instituters, and a thorough and deep probe is called for." - Report of the National Commission on Agriculture (NCA).

"The overall performance of IARI scientists in terms of high level scientific contributions is not commensurate with the quality and quantity of the scientific input as well as of the financial outlay." - Report of the Achievement Audit Committee, (IARI).

"What often passes as fundamental research in agriculture is but a variation of a similar study done elsewhere having little or on relevance to our conditions. Sometimes research workers having no connection whatsoever with the field of specialisation conduct work in sheer oblivion of the actual problem." - Interim Report of the National Commission on Agriculture.

The National Commission on Agriculture asked each of the institutes to list at least five of their outstanding achievements in the different categories of research. On the basis of the replies received, the Commission concluded, "In most of these researches (which included the best work done

in these institutes) the techniques employed were well-known and no new grounds had been explored in the form of techniques of knowledge. Frankly speaking, it is doubted if more than half a dozen achievements would fall under the category of outstanding."

What ails agricultural research in India? This question has arisen time and again in the context of the numerous irregularities in the Indian Council of Agricultural Research and its institutes that have been exposed in the press as well as in the Parliament, and even confirmed by official committees appointed to go into the functioning of the agricultural research set-up. Still it seems that more has been left unsaid than what has been said regarding the malfunctioning of the ICAR.

Although there is a good deal of dissatisfaction among agricultural scientists regarding their working conditions, it is unfortunate that knowledge regarding the goings on in one research institute remains unknown to most of the scientists in the other institutes. This is one of the factors that hinders the quest for united action by the scientists for improving their working conditions and the atmosphere of scientific research in these labs. Many farm scientists have not even been able to go through the findings or recommendations of the various official committees which have inquired into the affairs of the ICAR, perhaps because these documents are not easily accessible, specially in the research institutes located in remote areas.

Historical Evolution

The Imperial Council of Agricultural Research, set up in 1929 on the basis of the recommendations of the Royal Commission on Agriculture, was renamed the Indian Council of Agricultural Research (ICAR) in 1947. At this stage the ICAR had the broad objective of promoting, guiding and coordinating agricultural and veterinary research throughout India, training research workers under a scheme of research scholarships or other ways and collecting and disseminating information on agricultural and veterinary issues, but it was not supposed to have research institutions directly under its

control, or to employ its own staff of experts. It was only supposed to determine whether a particular scheme of research was of all-India or local importance or whether it would best be carried out under a central or provincial research institution, and then to make suitable grants for this research scheme after getting it examined from experts.

After independence various experts teams were constituted to go into the question of organisation of agricultural research in the country. The University Education Commission (1949) had suggested a reorientation of agricultural education somewhat on the lines of Land Grant College of the USA and the first agriculture university on this model was set up in Pantnagar, Uttar Pradesh, in 1960 with ICAR grants, with support from the United States Agency for International Development (USAID) and in collaboration with the University of Illinois.

The following expert teams were constituted to examine the various aspects of agricultural research, education, extension and administration.

1. The first Joint Indo-American Team on Agricultural Research and Education (1955);
2. the Agricultural Administration Committee - Nalagarh Committee (1958);
3. the Second Joint Indo-American Team on Agricultural Education, Research and Extension (1960);
4. the Committee for Agricultural Universities Legislation - Cummings Committee (1962), and
5. the Agricultural Research Review Team (1963).

It is important to note the heavy foreign influence in the constitution of these expert teams on the basis of whose recommendations, specially of the last mentioned committee, a decision to re-organise the agricultural research set-up in the country was taken. Under this sweeping reorganisation all research institutions under the Ministry of Food and Agriculture were brought under the control of the ICAR. Further all recruitments and promotions of agricultural

scientists previously done by the UPSC were now vested with the ICAR.

In 1929, when the Imperial Council of Agricultural Research was set up as a society under the Societies Registration Act it could not maintain research institutes directly under its control nor could it employ its own staff or experts. But according to the change of status after this recoganisation this registered society was entitled to both these things. Later on to deny justice to its employees the ICAR could take the stand in the courts of law that it is not amenable to writ petitions and it is not bound by its own rules and by-laws since it is merely a society, and hence it actions are not challengable. Such a situation certainly had profound implications for the security of the employees, and they were exposed to victimisation tactics of various kinds. Thus the breeding ground for many later day-irregularities in the ICAR institutes including victimisation and curbing of dissent was really prepared by this reorganisation in which foreign interests had an important hand.

The problems created by this peculiar legal position of the ICAR as a registered society have prevented many agricultural scientists from seeking redressal of the injustice done to them, and discouraged others to do anything that would annoy the powers that be, as otherwise they would be exposed to ruthless victimisation of which there may be no redressal. Thirteen years after the reorganisation of the ICAR along these lines the Estimates Committee of the Indian Parliament (Sixth Lok Sabha) noted in its thirty-fifth report, which deals with the working conditions of farm scientists, that there is a lot of resentment among agricultural scientists over this issue.

The PAC Report

The Public Accounts Committee of the Indian Parliament (Sixth Lok Sabha) has also drawn attention to several irregularities in the ICAR in its 134th report.

One of the most serious irregularities detected by the PAC is that the proper procedures regarding the selection of

research schemes are being neglected. Scientific panels have been appointed by the ICAR for scrutinising the various research schemes proposed and evaluating those which are already being carried out. However, the meetings of these scientific panels have been very few and it was impossible for the scientific panels to do justice to their heavy responsibilities in these few meetings. As the PAC report noted, "the meetings of the scientific panels have become more or less a formality schemes, and their progress and evaluation largely on lesser functionaries in the secretariat of the ICAR".

The Committee was also perturbed to note that a very large number of ad hoc research schemes for which money was allocated by the ICAR were terminated, discontinued or abandoned. In fact the number of such schemes during the period 1973-74 to 1977-79 was a much as 197. The discontinuance or abandonment of research schemes year after year indicates that in these cases the schemes were sanctioned without proper assessment of their need and merit and the competence of those who were to work on it, leading to massive economic wastage. The Committee also found that farmers were not involved at any stage in the selection of research projects, under the present-day system of project selection. Consequently there is the danger of at least some part of the research effort getting far removed from the problems faced by the farmers in the field and being largely of academic interest.

The PAC Report has also noted that the ICAR is not strict about imposing financial discipline, and in fact has been sanctioning such generous budgets that they cannot even be absorbed by the concerned research agencies. For example, during 1975-76 the ICAR paid Rs. 7.38 crores to agricultural universities while they could spend only Rs. 5.44 crores. In the same year Rs. 5.11 crores were paid for All India Coordinated Projects whereas only Rs. 4.06 crores could be spent. Similarly while Rs. 1.02 crores were made available for ad hoc projects only Rs. 62.49 lakhs could be spent.

Moreover, a careful look at the accounts of the ICAR reveals that its budgst receipts have been going up compared to

not only the original budget estimates but even the revised estimates. At the same time there have been shortfalls in the utilization of grants given by the government to ICAR leading to unspent balances carried over from year to year. The ICAR has also incurred an expenditure of approximately Rs. 16 lakhs in excess of funds received under PL 480 to the end of March 1976. The PAC report has further indicted the callous neglect on the part of the ICAR in properly utilising the funds made available through the collection of agricultural produces. Instead of utilising these funds for deserving research schemes the ICAR allowed them to accumulate or diverted them to the construction of office buildings, hostels and staff quarters for the staff of the Headquarters. Further the ICAR has allowed the cash balances amounting to Rs. 2.8 crores to lie dormant in fixed deposits although these should have been invested in fruitful educational and research work. The PAC report has called it "an act of gross negligence" not to utilise funds for any fruitful endeavour for a period of over ten years. The PAC report has noted that the dues owed mounted till they have now reached massive amounts without any effort having been made to realize them.

In an earlier report (fourth report) the PAC (Fifth Lok Sabha) had adversely commented upon the large amount of money outstanding for want of utilisation certificates in respect of grants paid by the ICAR. In their reply the Ministry of Agriculture had intimated the Committee on 23rd February, 1972, that the Council would be able to clear all cases of outstanding utilisation certificates substantially and also prevent accumulation of outstandings in future. In its latest report the PAC has regretfully noted that so far no substantial improvement has been made in this regard and out of grants paid up to March 31, 1976 as on December 31, 1978 utilization certificates were outstanding in respect of grants aggregating Rs. 635.45 lakhs.

In addition, the PAC Report has also drawn attention to several special causes of losses and defalcation of cash in the institute and units of ICAR.

The NCA Report

The National Commission of Agriculture has also indicted some of these and some additional aspects of the functioning of the ICAR in the part of its report relating to agricultural research, education and extension. Deploring the poor performance of many scientific panels, it adds, "the ICAR does not seem to have taken serious cognisance of either the panels' suggestions, or their negligence."

With reference to lack of proper planning and foresight on the part of the ICAR the Commission has noted, "It is rather difficult to understand why the share of grants of the ICAR institutes in respect of ad hoc schemes should be so large. They should ordinarily be covered by their plan and non-plan allocations of funds for research. No problem of importance should ordinarily be missed which would need to be financed separately from ad hoc grants. One or two cases of exigency may arise due to inadvertence but not deserving of massive grants as are being sanctioned."

The Commission in a veiled way has also expressed regret at the deteriorating standard of research, "Some of the ICAR institutes inherited glorious traditions insofar as their contribution in the scientific field are concerned. It cannot be said with full conviction that they have been maintaining those traditions. Nor can we say that the more recent institutes have made as significant a mark as some of the old ones did in regard to the quality of their scientific contributions and dedicated pursuit of knowledge. Everything is not well with the research institutes, and a thorough and deep probe is called for."

Regarding the performance of the coordinated research projects which have been undertaken (on the basis of 75 per cent of the grants being met by ICAR) to avoid research work in critical areas remaining isolated and uncoordinated the Commission notes that generally speaking the research workers in the co-ordinated projects are oblivious of the research work being done elsewhere in the country, thereby defeating the very objective of initiating these projects. Further

some of the research projects "have turned out to be mere data collecting units in a routine manner to the detriment of their research contents. This has created a sense of frustration in active researchers who have lost interest and initiative in their work. The real purpose of coordinated projects to foster group thinking and collaboration has thereby been lost sight of".

The Commission notes that the advent of these projects in some institutes has led to the closure of projects in the same field being already conducted in the institute, a development which was not intended and which leads to the harmful effect of local problems connected with the research project being neglected. Further, because of certain financial and other advantages available under these projects attempts have been made to bring all shorts of research schemes, which do not satisfy the relevant criteria, under the ambit of these projects. "This has regrettably given rise to many unworthy projects, and has considerably diluted their importance and diverted their goals."

Isolation of the project staff from the general stream of researchers at the implementation as well as the project formulation stage, over concentration of these projects at a few institutes such as the IARI and the IVRI and the overcrowding at the evaluation workshops are some of the other problems raised in the NCA report regarding the All India Coordinated Projects.

But the most shocking fact that has been highlighted in the NCA Report is that the yields in the neighbouring areas of research institutes of those crops in which these institutes specialise have been declining over the years. To quote, "The impact of research results, if any, should be evident at least in the region close to the institutes and in other regions placed in similar conditions in regard to applications of results of research. This is all the more expected in view of the widely publicized field days which are held for the benefit of the neighbouring farmers." But the opposite seems to be case in some of the ICAR institutes.

Central Rice Research Institute was set up in Cuttack (Orissa) in 1946, but the rice yields in the neighbouring areas have been declining. During the decade 1960-63 to 1970-73 the average yield per hectare declined by about 15 per cent in Cuttack, and also declined, though to a lesser extent, in other neighbouring regions of Balasore and Dhenkanal. Sugarcane Breeding institute was set up in Coimbatore, Tamil Nadu in 1912 but during this decade the yield of sugarcane in this district fell by about 10 per cent. Central Potato Research Institute was set up in Simla in 1949 but during this decade the yield of potatoes in Simla fell by about 2 per cent and that in Jalandhar fell by about 16 per cent. Central Tobacco Research Institute was set up in Rajamundry, Andhra Pradesh, but during this decade the tobacco yields in neighbouring Guntur district fell by nearly 25 per cent.

Further, the statistics given by the NCA have revealed that in spite of the increased area coverage by the high yielding varieties, paddy, jowar and bajra did not show increase in production and productivity, and instead the reverse was the case.

From 1969-70 to 1972-73 the yield of paddy remained constant while the yield of jowar declined by 18 per cent and that of bajra declined by 22 per cent.

The NCA Report has also drawn pointed attention to the tendency of many institutes to blindly seek more and more funds for expansion instead of giving attention to consolidating the existing facilities and ensuring their proper utilisation. To quote, "The possession of more laboratory space, more equipment, more staff of all categories, research scholars and projects is the order of the day and a way of becoming important, also in the name of progress but in complete disregard of the question of competence and management ability. No string seems to be bad enough to pull to achieve these ends. Some of the big institutes have by this process alone expanded beyond limit, and even then they do not seem to feel satisfied. Despite rapid obsolescence in science, most institutes

have been adding one division after another without thinking of discarding any."

This report also notes that the original objectives of almost all the institutes have suffered due to modifications including deletion, revision, and expansion in the course of years, but in most of the cases the reasons for these changes are not traceable. This report also found a general lack of awareness about the research policy of the institutes among the staff members.

Regarding the selection of problems for carrying out research, this report notes that most often the researcher gets at this problem by reading scientific literature in his own discipline, either Indian or foreign, and somehow tries to fit in with local or Indian conditions. Rarely does he go out in the field and pick up his problems from his own direct observations or those of his colleagues engaged in field work.

The Staff Research Councils (SRCs) constituted for the purpose of proper selection of research projects have not proved very useful. The NCA Report notes "Our impression is that SRC is not an effective body partly by virtue of its size and partly due to the most commonly observed lack of interest of one department in the work of another, and of the lack of constructive, free and frank criticism so important in sustaining the spirit of scientific enquiry. The SRC thus turns out to be a routine approving body. Whatever criticism of scurtiny a project receives is at the divisional or occassionally at the individual level. But there also the same lack of interest in another's work and lack of constructive criticism makes the whole process a drab routine. The SRC has been in most of the institutes in a moribund state for one reason or the other and it is the Divisional Council which does the scientific scrutiny, only the routine sanction being left to the SRC."

Regarding the utilisation of scientific equipment in the labs of these institutes this report says, "It is common experience that costly instruments, many of which are imported, suffer from poor maintenance, repair and under-utilisation. Lack of spare parts and bad handling by a number of research workers who perhaps use the instruments only occasionally is responsible for poor maintenance leading often to complete breakdown. A scientist considers it prestigious to own a costly instrument by himself, even though he may not utilise it to its full capacity and hence many a machine-hour is lost."

Regarding direct contact of research scientists with the farmers the NCA Report has noted, "The contacts of the research scientists with the end-users of the results have been loose. This leads to delays and often confusion, and what is more harmful, a complacent attitude on the part of the research scientist. Again since extension has been thought to be less important a vocation, it has generally been relegated to the less enterprising scientists. The results are disastrous. The extension personnel cannot afford to be scientifically less equipped, and, therefore provisions for their intensive training have been stressed in the interim report. Research scientists should be occasionally involved in extension work, so that they have first-hand knowledge of the difficulties, if any, of the transfer of research results into the field and solve them right there."

Regarding the periodic evaluation of the research-work done at the various institute the NCA Report has noted, "It has been the practice of the ICAR to constitute for each institute under its control an achievement audit committee every five years for the purpose of assessing its performance. The primary aim is to improve the working of the institute on the basis of suggestions and recommendations of the committee. Unless sincerity and seriousness are the keynote of the process, a vicious circle sets in. A serious minded committee may do a thorought job and recommend certain not so difficult to implement changes, but for some unknown reasons they may remain unheeded until the next committee is appointed. Having seen the fate of earlier recommendations the second committee may feel disinclined to make any recommendations of consequence. In this way, an institution nobly begun with high aims languishes in the course of ten years or so. If the

seriousness is wanting in the committee itself the degeneration comes quickly."

Regarding the actual response of the institutes to the recommendations made by these committees, the NCA report notes, "while some of the institutes genuinely wanted to implement some of the recommendations, which they might have taken pains to convince the committee to make, there are others who care less. Nor did the ICAR put its weight to set matters right in the direction of what was good for the institutes. In this way, the whole exercise becomes a futile ritual."

Discrimination is exercised even in allowing scientists to participate in scientific conferences, seminars etc. While such opportunities are sought to be denied to deserving scientists who may happen to have incurred the displeasure of the powers that be, at the same time the powerful scientists try to obtain as many invitations as possible for themselves and are forever on jaunts to attend conferences and seminars. The NCA Report has noted in this context, "It has been said of scientist administrators that they have to sign official papers while changing planes at the airport. It sounds exaggerated but not quite untrue. The bigger the stature of the institute or agency and of the person heading it, the truer this kind of situation is for him. Heads of institutes and divisions often vie with one another to make their importance felt elsewhere, but by absenting themselves from their normal duties at the headquarters. By the usual way of rationalising attendance at every meeting to be an essential duty, the primary work at the institute is neglected. In no time lack of seriousness begins to permeate among workers at all levels. This harmful trend should be put an end to, by making it obligatory on the part of all categories of research workers including the heads of divisions and institutes not to be away, except under special circumstances, for more than one week or so from the headquarters for attending meetings, conferences, symposia etc."

Indian Agricultural Research Institute

On the morning of 5th May, 1972, Mrs. Shah, a housewife of East Patel Nagar locality in New Delhi, returned to her home after fetching milk from the nearby milk booth. She was a bit surprised to see that her husband, Dr. Vinod Shah who was an agronomist in the Indian Agricultural Research Institute, had not yet emerged from the drawing room where she presumed he had bolted himself in the early morning to finish some urgent work. She was not unduly worried, however, and busied herself in her daily chores. However her son, 8 year old Vihang, was more curious, like all children, and ventured to peep from the window to find out what his father was up to so early in the morning.

Imagine his shock when he saw that his father was lying in a dishevelled state on the floor. Perhaps he did not immediately realise the full meaning of the tragedy witnessed by him but even his child's mind could easily make up that something was seriously wrong and so he cried out for his mother. The alarmed mother rushed to her son standing near the drawing room window pointing to the tragic sight inside the room, the rope around the neck of her husband's body, the other portion of it tied to the ceiling fan.

On hearing her cries neighbours rushed in to make inquiries and soon the door of the drawing room was forced open. Next day this suicide made newspaper headlines as a clear case of a scientist being driven to the extreme step of taking his life due to frustrations at every step in his professional life. A capable, sensitive and uncompromisingly honest man according to all those who knew him, 35 years old Dr. Shah had not been able to adjust himself to the atmosphere of the scientific establishment in India. The glaring irregularities victimisation, nepotism, bogus research, sycophancy - repelled him. And he also realized that an individual scientist who tried to oppose the system was helpless against its might. The final blow was dealt when a junior scientist was selected to supersede him in the matter of a promotion, Dr. Shah decided that the only way open to him to

draw the country's attention to the state of the scientific atmosphere was to sacrifice himself. As he said in his suicide note, "I think the time has come again when a scientist will have to sacrifice his life in disgust so that other scientists may get proper treatment."

Dr. Shah's suicide was not the first one committed by an IARI scientist, although it attracted more attention partly because of his youth and partly because of the suicide note left behind by him in which he clearly explained the dishonesty and irregularities of the scientific establishment which had disillusioned him so much. Another case of a scientist's suicide in the same Indian Agricultural Research Institute was that of Dr. M.T. Joseph. After acquiring specialisation in his discipline form abroad Dr. Joseph had made several efforts to improve his professional prospects. But the bureaucratic bosses refused to forward the numerous applications put in by him. In one case he obtained a job in a prestigious institute on the basis of an individual application sent by him but could not avail of this offer as his application had not been forwarded by the higher authorities through the proper channels. This, it is widely believed, is what led Dr. Joseph to take the extreme step of committing suicide.

Similarly more than one research student from this institute have been driven to the extreme step of taking their life due to frustration in professional life.

An Achievement Audit Committee Report of this Institute has also presented evidence of the dissatisfaction among IARI scientists regarding their working conditions. In response to the query of this committee whether appointments are made on the basis of merit, 34 per cent of the staff members gave a positive response while 48 per cent were of the opinion that appointments are not made on the basis of merit. Regarding the housing and living conditions and environments being favourable to work 67 per cent of the staff members said that these were not so. 71 per cent of the scientists said that the salary levels and other benefits here did not compare favourably with the same elsewhere .46 per cent said that the

mechanism for selecting persons for outstanding work was not satisfactory 42 per cent felt that divisional and institute level administration was not satisfactory for growth.

This Report was quite critical of several pompous or exaggerated statements made in IARI documents on research programmes of the institute. It opines, "Frankly speaking this document has been presented in an extremely unrealistic and a far too ambitious manner. The question of priorities has not received any attention whatsoever. One or two examples may be given. The genetics division puts 'Human Genetics' under the heading 'creating new knowledge'. This is pleasantly vague and may mean everything but nothing specific. It is not mentioned what specific aspect of human genetics which is going to yield new knowledge and be pertinent to the research activity of the institute is to be taken up. A large number of other specific examples can be picked up from this publication. It appears to the Committee that the concept of new knowledge as we understand in science has been considerably diluted to include any observation as a piece of knowledge. In fact the Committee asked itself the question - what new knowledge has emanated from the IARI in the course of the last five years. It could find hardly one or two. There have been a large number of very significant developmental contributions as a result of thorough going applied research. They are by no means new knowledge."

The Committee has also noted its finding that "some of the divisions were glossing over the real problems and were more or less disinclined to go in depth." Finally the Committee has concluded. "The Scientists of IARI have made some excellent contributions but their overall performance in terms of high level scientific contributions is not commensurate with the quality and quantity of the scientific input as well as of the financial outlay."

The Report of the Achievement Audit Committee has also criticised the neglect of basic research in this national institute. To quote, "Most of the divisions in this institute during the past few years have been engaged in some sort of

applied research. Applied research is undoubtedly rewarding. The majority of the researchers seem to be of the opinion that their main objective is to carry out applied research leading to increased production. So long as they are in a position to solve problems in an empirical way by the trial and error method, they do not particularly bother themselves with fundamental research. This attitude of research scientists is unacceptable if a long-range view is taken of the role and functions of IARI. In fact, an Institute of the calibre of IARI should engage itself more and more in basic problems, especially those of national interest having promise of practical utilization. New knowledge is created in this way." In another place the Committee has mocked at the lip sympathy paid officially in IARI to basic research while neglecting it in practice. To quote, "Such statements as 'good basic research is the foundation on which effective applied research programmes can be created' sound platitudinous in the light of what IARI has attained in the field of basic research."

In addition to the generally poor quality of research several cases of blatantly dishonest research have also come to light.

In a series of experiments conducted over four years from 1967-98 to 1970-71 at the IARI and Pantnagar a pulse variety known as Baisakhi Moong was found to have a yield of between 10 to 12 quintals per hectare. The achievement of this high yield attracted wide attention and brought laurels to the scientists who had undertaken research on this new variety. However, following the allegations made by Dr. Shah in his suicide note, when the Gajendragadkar Committee inquired whether such claims were born out in the National Demonstrations, it was found that the yields were much lower (7.02 quintals and 6.80 quintals) in the demonstrations conducted at Rajasthan and Madhya Pradesh respectively. Worse still in Punjab and Delhi the yields were only about half of those claimed to have been obtained in the IARI experiments. From Himachal Pradesh it was reported that the Baiskhi Moong 'did not prove successful', and in Assam its

performance was held to have been 'not satisfactory'. In Orissa, the yield of Summer Moong was reported to be between 6 and 7 quintals per hectare provided it was not affected by yellow mossaic. The Committee concluded, "It seems that further experimental and demonstration work was necessary before the varieties were released."

Similarly, exaggerated claims relating to super-nutritious maize developed at the IARI later became a major scientific scandal. Initially the research had been credited with having developed 'a new strain of maize with the protein content doubled and having nutritious value like milk'. Some of these claims even bordered on the ridiculous viz. "What is more interesting is that children fed on this maize are less irritable, according to their mothers, than the milk-fed babies and if a similar effect occurs in adults, then those with short tempers can be recommended two spoons of Pusa high lysine maize daily". Subsequent experience revealed all such claims to be figments of imagination and the maize-variety in question, yellow opaque-maize whose yield was only 50 per cent of the normal maize grown by the farmers was never accepted by them for cultivations in any part of the country. Another major scandal of this kind relates to the Sharbati Sonara variety of wheat.

This scandalous story began with the attempts to improve on the Sonara 64 variety of wheat (which first heralded the so called green revolution in India) to improve on some of its shortcomings, mainly in India. In 1967, Dr. M.S. Swaminathan, who had carried out research subjecting Sonara 64 seeds to a combination of gamma radiation and ultravoilet light, announced that he had succeeded in producing an amber wheat, to be called Sharbati Sonara, which in addition had better baking qualities and was better than its parent Sonara 64 in terms of both protein and lysine (Lysine is an amino acid that is high in animal protein but low in plant protein and thus often deficient in vegetarian diets).

Impressive claims indeed, and at one stage Sharbati Sonara seemed set to give Indian agriculture a new

breakthrough, specially when Swaminathan further told a New Delhi symposium in October 1967 that the protein content of Sharbati Sonara was nearly comparable with milk protein with regard to lysine content. At that time, thanks to the excellent public relations maintained by Dr. Swaminathan, the press lavished fulsome press on Sharbati Sonara.

Just as Swaminathan and his Sharbati Sonara were riding the crest of high-powered publicity, however, several reputed foreign scientists reported that there was no significant difference regarding lysine and protein content of this and its parent variety. Swaminathan's initial reaction to these exposures was to tone down somewhat his claims in three papers published in 1968, but then suddenly out of the blue in April 1970, he submitted one of his already published papers to a short-lived academic journal making the most extreme claim of two-and-a-half times the lysine content for Sharbati Sonara.

Soon after the publication of this paper Swaminathan won the Magsaysay Award of $10,000. The award citation made special mention of his development of Sharbati Sonara with a high lysine and protein content. A few months after he won this award, Dr. Swaminathan was made the Director-General of ICAR.

Ironically enough by this time Sharbati Sonara, which at no time had played any significant role in spreading the 'green revolution' once visualized for it, had made its final exit because of its susceptibility to rust. Thus apart from its contribution to advancing the career of an individual 'L' affaire Sharbati Sonara would have remained a scandalous but closed chapter in the records of agricultural research but for the renewed interest in the affairs of the ICAR following the tragic suicide note and because the evidence of Mrs. Shah and a colleague, Dr. P.N. Patel, had revealed that Dr. Shah had met Dr. Swaminathan sometime before committing suicide for voicing his professional grievances and since then had not taken an food despite the entreaties of his wife and children. Dr. Swaminathan was in the dock. Significantly enough, Dr. Shah had alleged in his suicide note addressed to Dr. Swaminathan,

"A lot of unscientific data are collected and passed on to you to fit your line of thinking". At the same time, "A person with ideas and constructive scientific criticism is always victimised.

As is well known, the Gajendragadkar Committee or the ICAR Enquirey Committee, also enquired into the allegations of fraudulent research made by Dr. Sinh and some others and found that there was substance in them. While commenting on the Sharbati Sonara controversy, the Committee noted that the adverse comments on the claims made for this wheat variety by reputed scientists and organisations had been brought to the notice of agricultural scientists, at the All India Wheat workshop held at Indore in August, 1969. It was then resolved in this meeting that the lysine content should be verified at the National Institute of Nutrition. Hyderabad, and Nutrition Research Laboratory, Mysore. The Committee considered it "very surprising and indeed regrettable" that no wheat of this variety was sent during the past years to these laboratories for analysis. On the recommendation of its expert Panel of Advisers, the Committee on its own behalf sent samples of this variety to laboratories for the analysis of its lysine content. It was concluded on the basis of this analysis that "these results are somewhat higher but nowhere near the 4.61 per cent as mentioned by Dr. M.S. Swaminathan... It seems that Dr. Swaminathan has not been sufficiently careful in his reference to the lysine content of Sharbati Sonara".

Another serious issue that came up before the commission related to the allegation made by Dr. Y.P. Gupta of the Bio-Chemistry Division of the Indian Agricultural Research Institute (IARI), who had contested the data on the protein and lysine content of Sharbati Sonara published by Dr. Swaminathan at an early stage and who had himself worked on the lysine content of different varieties of wheat, that in the half-yearly report for period ending October, 1968, he had reported the lysine content of Sonara-64 to be 3.26 per cent but that the Head of the Division deliberately changed it to 2.26 per cent so that Sharbati Sonara might appear in more favourable light in comparison to it. This allegation acquired

significance when Dr. Y.P. Gupta also alleged that the Head of the Division had close contacts with Dr. Swaminathan and had indulged in this gross irregularity obviously with a way to gaining the ICAR Director-General's favour. Referring to this and similar allegations as "very serious", the Committee noted that "mere refutation of these allegations will not do."

Just as the other recommendations of the Committee were shelved, however, and the ICAR and its related institutions continued to function in the same old rut, this observation of the Committee was also neglected and the guilty persons went unpunished.

THE LAST TESTAMENT

-Being the suicide note of Dr. Vinod Shah addressed to Dr. M.S. Swaminathan, then Director of the Indian Agricultural Research Institute (IARI).

My Dear Dr. Swaminathan,

It has become impossible for me to bear the happenings around me in the recent past.

1. It is too much of a struggle to get a better opportunity, as I had indicated to you on 3rd May, 1972. I have been disowned by crops (breeding) men as well as by agronomy men in authority.
2. Whenever it suits some the seniority counts in the same line. At other times seniority, contribution, basic qualifications, capacity to inspire intelligent young scientists etc., are completely ignored e.g., the appointment of Dr. Dey as Head of the Division of Agronomy, selection of Dr. Prasad as Professor of Agronomy (men with qualifications in plant physiology and soil science).
3. Head of Division and Professor could kill the initiative of section officers in the following way (as it happened to me) -

(i) Not admitting them to the post graduate facility for a long time.

(ii) Not giving them students.

(iii) Supporting Research Assistants, SRAS, field men, etc. against the section officers in indiscipline, acquiescing in failure to discharge their duties promptly etc. I was not given ad-hoc appointment on my present post when nobody else senior to me had any experience on maize. No ad-hoc appointment as Professor was made because otherwise I would get it.

(iv) Creating such an atmosphere that section officers are always to be blamed even when they are doing everything in the interest of work.

(v) Section Officers should not complain; else the matter will directed against them. To quote "The sub ordinate will put false charges and you would not be able to stop them or correct them."

(vi) A lot of unscientific data are collected and passed on to fit in your line of thinking.

(vii) A person with ideas and constructive scientific criticism is always victimized whenever it comes to promotion or getting importance. Even in the audit reports the achievements and contributions made by the section as well as programme of future work were changed so that they do not appear outstanding.

(viii) Administrative bottlenecks are so many and are often humiliating.

(xi) Director or Director-General seldom like to hear complaints against the Head of a Division or Professor.

(x) Mediocre people are also recruited in preference to candidates with experience, energy and drive because they have tacts to keep the higher authorities close to them by fair or foul means.

I think that a time has come again when a scientist will have to sacrifice his life in disgust so that other scientists may get proper treatment. May I bid you good-by and many more years of dedicated life. I've only one request to make - you may kindly guard the interest of the persons dedicated to work with intelligence.

Dr. Mahapatra, myself, Dr. Dastane, Dr. Bhardwaj, Dr. Sadaphal, Dr. Panday etc. are struggling hard against heavy onslaught, mentally as well as administratively. You may be supporting mediocre and pseudo-agronomists at the expense of intelligent agronomists.

Wish you all the best.

Yours sincerely,
Sd/-
Dr. Vinod Shah

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Section I -All the development news from last month, collected from nearly 50 newspapers, magazines and journals and classified into 15 subjects.

Section II-References of all important articles and reports, from the same publications and classified in a similar way.

Section III-Information about new books, and where these have been reviewed.

Section IV-Comprehensive coverage of an important development issue-a detailed and thought-provoking report that will be useful for a long time to come.

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II PRESS-CLIPPINGS SERVICE ON DEVELOPMENT ISSUES IN INDIA DESIGNED TO MEET YOUR HIGHLY SPECIFIC NEEDS

You (or your organisation/institution/library)are interested in studying or keeping well informed about India's development experience as a whole, but at any particular time you may be involved fully only in a part of it and on this part you may need as detailed information as is possible to get. This may be because you are implementing a research/action project on thesis subject, or preparing a book, document ~~or this~~ on this subject, and so on.

It is to meet this specific need that a press-clippings service has been started. Under this scheme you assign us a subject-it may be a wide subject such as 'artisans and craftsmen' or 'labour' or a part of a wide subject such as 'leather artisans' or 'bonded labour' or 'labour issues in Delhi'.

After receiving your subject we then read about 50 leading newspapers and magazines for one month to find all news, reports and articles which deal with the subject that you've assigned to us. These clippings are carefully collected, the name and date of the publication is written on each clipping and at the end of the month the entire set is mailed to you by registered post.

Thus you are able to keep in close touch with the subject of your interest month after month. You can assign one or more subjects to us on the development experience of India. The charges will depend on how wide are the subjects you've given to us.

So please define your subject or subjects precisely and write to us and we'll send you the cost estimate. Of course, you can also indicate the budget you can afford, and we'll try our best to accommodate your requirements within this budget.

The utility of our service can be seen from the following example- Organisation 'A' has asked us to cover the subject 'artisans and craftsmen' for them. We charge them Rs. 300/- per

month for this. But if this organisation tried to collect this information on its own, then their budget would be

(i) Cost of buying about 50 newspapers and magazines for a month - Rs. 1500/-

(ii) Cost of employing a person to read, mark, cut and collect clippings from these newspapers and magazines - At least Rs. 1500.

Thus the effort that would cost at least Rs. 3000/- is available form us at one-tenth that cost Rs. 300/-. It is possible for us to serve you at this low cost because of the infra structure that already exists.

We consult newspapers and magazines in English and Hindi. The importance of Indian languages cannot be over-emphasised-often these are closer to grass-roots reality. The most important story of the last decade - the warning about the Bhopal disaster - was written by a journalist writing in Hindi for some newspapers.

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III SHURUAAT - JOURNAL IN HINDI FOR WORKING CLASS READERSHIP.

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IV BOOKS AND PAMPHLETS IN ENGLISH AND HINDI

Note: Several of these publications are useful for distribution as background material in seminars, workshops.